

JULY 1979 \$1.00

Popular Mechanics

**DRIVE YOUR
DREAM CONVERTIBLE
THIS SUMMER**

2,000,000-mile report

**Champ/Colt owners get
better mileage — but
Omni/Horizon owners
are happier**

COMPLETE PLANS:

- Classic oak dining table
- Kids' climber

COLOR TV:

**7 in-store tests
before you buy**

A BANG-UP 4TH!

**Brass cannons
you make
from kits**

Chop it...
Restore it...
Import it... or

**Build your own
from a kit!**



**COMPLETE GUIDE
TO SMALL MOTORCYCLES:**
A great way to go on very little gas



Illustration: Andrew Thomas, design: Ken Karpovich

GM's New Front-Wheel-Drive Cars

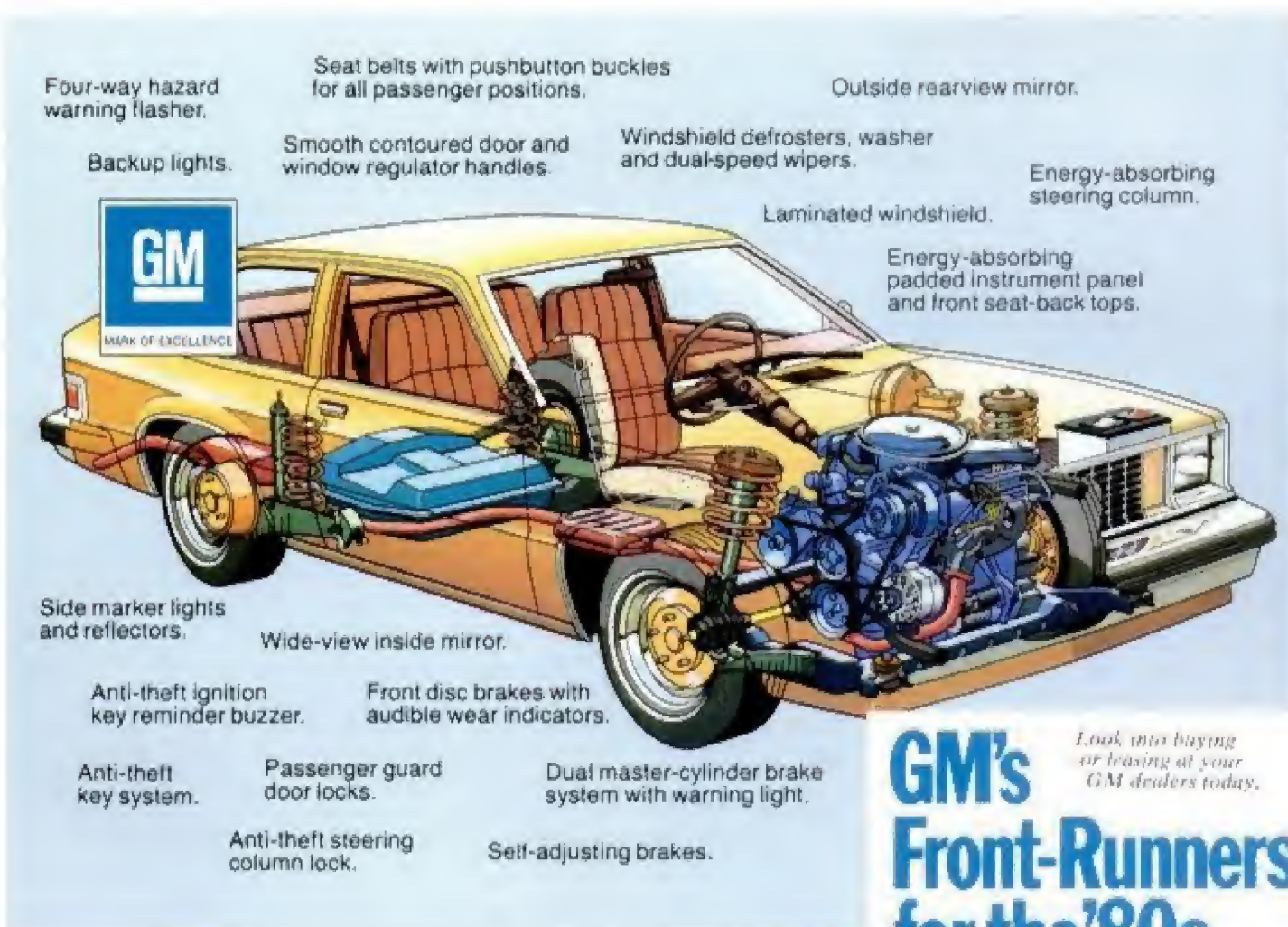
For occupant-protection and accident-avoidance, standard safety features include

energy-absorbing steering column, padded instrument panel, dual master-cylinder braking system, side marker lights and more.

Every new front-wheel-drive Chevrolet Citation, Pontiac Phoenix, Oldsmobile Omega and Buick Skylark offers an impressive list of standard safety features. Among

these are some developed by General Motors, such as the energy-absorbing steering column and audible wear indicators for our front disc brakes.

In addition, you'll notice certain provisions to help prevent theft. Like the safety features, we hope you'll never need them. But they're there just in case.



GM's
Front-Runners
for the '80s.

Chevrolet Citation, Pontiac Phoenix,
Oldsmobile Omega, Buick Skylark.

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OLYMPUS. THE EYE OF U.P.I.



U.P.I. Photo, Fireman slips on ice fighting fire in sub-zero weather.

U.P.I. Photo, U.S. space shuttle prepares for first flight.

To go out and grab the news that's being made, you need a camera that's made to cover the news. That's why United Press International has Olympus cameras on assignment around the world. These gutsy, gifted 35 SLRs have impressed the skeptical press. Because of their ruggedness and reliability. Their features and finesse.

U.P.I. likes to travel light. Olympus OM cameras are a third smaller and lighter than their bulky, boxy ancestors. But we kept the controls amply proportioned.

U.P.I. takes cameras along that can take it. Random samples from the OM-1 and OM-2 production line are brutalized with a 100,000 life cycle test. That's equal to 100 years of use.

U.P.I. needs a system that's BIG.

Olympus has the largest compact SLR system in the world, with over 300 components. And it's still growing.

U.P.I. can count on the 1 and the 2.

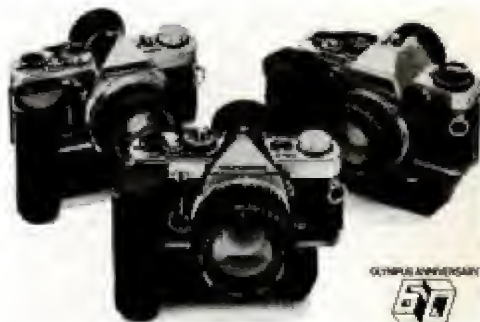
The OM-1 has outsold all other compact SLRs. It was the first, and is still the last word in providing full exposure control.

It's a standard at U.P.I.

The OM-2 is the fully automatic camera that offers greater accuracy in light measurement. Because internal sensors measure the light that's reflected off the film during actual exposure of up to 2 minutes. By also incorporating the full exposure control of the OM-1, the OM-2 becomes the ultimate SLR.

For a detailed brochure, write to Olympus, Woodbury, NY 11797. You'll find a lot of information that'll be news to you—but wasn't news to U.P.I.

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On the cover

Even though Detroit no longer makes convertibles, you can still get that dream roadster—by chopping down a sedan, restoring a vintage gem, importing a new one or building an open-top from a kit. Our composite cover shows (from the top) a chopped '79 Seville, a restored '65 Mustang and a new Lancia Zagato (photographed by Peter Samerjan). Foreground: A '57 "T-Bird" on a VW chassis from a \$4395 kit by Veebirds, Inc. (photographed by Allen Birnbach).

Popular Mechanics

JULY 1979

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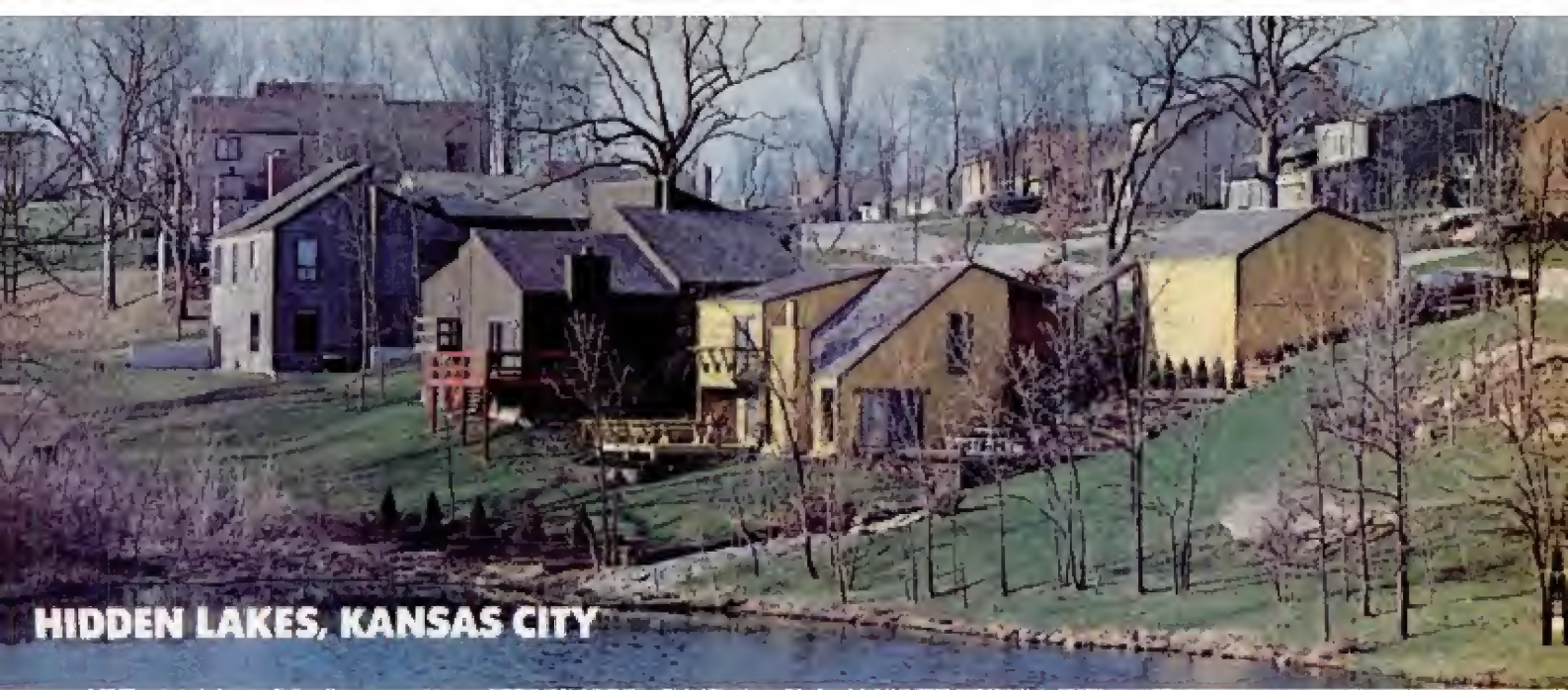


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This One



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Introducing... the Moonlighter



The newest and brightest idea in Kero-Sun portable heaters because it gives both heat and light wherever you need them!

When the summer sun goes down, the Moonlighter comes out and is it ever handy! We call it the Moonlighter because it does two jobs — It's a portable heater (with a cooktop you can heat a pot on) and a long-burning lantern for extra light. The Moonlighter is handsomely finished in sleek, rich-brown enamel with a clear pyrex combustion chamber. When the wick is burning, tiny subtle rainbows seem to dance up and down the glass. Lightweight, to go anywhere, it gives out 9,000 BTUs an hour and radiates 340 lumens. It burns for over 18 hours on only one gallon of clean-burning, safe kerosene. There's no smoke, no odor, and it has an automatic shut-off in case of tip-over. There's also a built-in automatic battery-powered igniter, so you need no matches to light it. See the Moonlighter at the Kero-Sun dealer nearest you and see if you don't take a shine to it!

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Please send me full facts about Kero-Sun portable heaters and the name of my nearest dealer.

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HINTS FROM READERS

Paint container



A blown fuse is a good, heavy-duty nontip container for touch-up or model paint. It's especially helpful when you mix small amounts of colors.—*Ernie Steward*

Marking equal spaces



One advantage of tapes with metric markings over those with English ones is clear when you divide a dimension into equal parts. Since metric measurements use decimal relationships, you don't have to convert fractions. Inside width of box above is 252 mm. This divides into three equal parts, marked at 84 and 168 mm. In inches, box width is about $9\frac{15}{16}$ in. The first mark is at $3\frac{9}{16}$ in.—*R.J. Reek*

Sharpening a plane iron



A carriage bolt is an acceptable sharpening jig for a plane iron. Attach iron to bolt with nut, washer and wingnut to get proper angle on stone.—*Harvey Muller*

Let me tell you about a way to have your own full- or part-time business in TV, audio, and video systems.

You can get started on a new career, earn extra money part-time, or prepare for retirement income by learning these new skills at home in your spare time. Read how we've helped people to bigger and brighter futures for over 60 years.

One of the secrets of the success of this school is the fact that its founder, J.E. Smith, was a teacher. So, when he originated his first course in radio over 60 years ago, it was carefully designed with training in mind. And that principle has guided us ever since. Today, every aspect of our courses in TV and Audio Servicing is student-oriented to make learning as fast and as easy as possible.

Exclusive Training Methods

That means you get far more than book learning. NRI gives you practical, "hands-on" experience as you progress. In our Master Course in TV and Audio Servicing, you actually construct a 25" diagonal solid-state color TV. One that features the very latest technology, including computer tuning that actually lets you program an entire evening's entertainment.

You start right with the basic parts and as you build it, you introduce and correct typical servicing problems, ending up with the complete unit, ready to use. That way, you get the actual bench time and intimate knowledge you need to handle real servicing problems. And before that, you even assemble some of your own electronic test instruments so you not only know how to use them, but how they work. That kind of training sticks with you... gives you extra confidence.

And Mr. Smith taught us something else, too. Not to go too fast. So, our courses have what we call "bite-size" lessons. That's another way of saying that they're easy to digest. Big enough to cover a specific subject thoroughly, but not so much that they'll overwhelm you. Written clearly, without a lot of gobbledygook. And we keep in mind that you're learning at home, so you take our lessons at your own pace. That way, you can learn in your spare time without interfering with your present job.

Professional Instructor/Engineers

We back you up with a fully qualified staff of professional instructor/engineers. They're there to help when you have a problem with any aspect of your studies. And because most of them actually helped plan your lessons



John E. Thompson, NRI President

and designed your equipment, you'll get answers right from the horse's mouth.

I might add that these are not a bunch of ivory-tower professor types. In between checking your lessons and giving you personal help, they're busy keeping up with the state of the art, designing new equipment and revising lessons to get you ready to handle even the latest equipment. The computer tuning we recently added to the TV set is a perfect case in point. Maybe a little exotic now, but when a problem like this hits your bench, you're ready for it. It's the kind of planning ahead our founder would have liked.

I Dare You to Do It

Now you might think I'm bragging a little too much on how good NRI is, and maybe I am. I'm mighty proud of our accomplishments. But the proof is how our training works in preparing people for actual jobs. So I'm inviting you to ask the only people who can give you a totally objective answer... professional TV and audio technicians. And here's my bet. Just look in your Yellow Pages for a couple of TV repair shops, ask to speak with anyone who actually does the repair work, and ask him what he thinks of NRI. I'll bet he says, "Do it!"

I'm not really sticking my neck out, because I know something you may not. Almost half the TV servicemen working out there have taken home-study courses. And among them, it's NRI more than three to one! I'll be happy to send you a copy of the national survey that proves it.

Why do the pros like us? Because NRI works. You take it at home so you don't have to go to classes. You take it in your spare time, so you can hold down your job while you get ready for your step forward. And you take it

easy, because our "bite-size" lessons make it easier, let you set your own pace.

Equipment Designed for Learning

NRI's equipment is exclusive. We design our own, so it's not somebody else's hobby kit or a stripped-down and mostly assembled commercial unit. It's designed so you really learn as you build, designed to give you lots of honest bench time, designed to give you the satisfaction of finishing up with a fully operable, top-quality unit that's comparable to any commercial set on the market. But you built it...you learned something on it! That's J.E. Smith's philosophy again.

It all boils down to the fact that we've aimed our training at a very practical goal... giving you the skills you need to move ahead in a rewarding career. To help you have your own full- or part-time business, we even include lessons that show you how to get started.

Send for Free Catalog, No Salesman Will Call

Send for our free 100-page catalog of electronics courses. It contains a complete description of every course, including each lesson, training kits, and experiments. Full-color photos show you exactly what your course will include in the way of test instruments, electronic components, and major kits like the AM/FM stereo with speakers, the NRI Discovery Lab[®] and computerized TV.

No salesman will call on you, either. Our catalog shows you what we have to offer you, what we can do for you. Look it over, then think about it and make your own decision without outside pressure. J.E. Smith always felt that his best students were the self-motivated ones.

I can only add this. With over 60 successful years and more than a million students behind us, we must be doing something right. So get started on your future. Send the postage-paid card and check the course that interests you. If already removed, write me direct and I'll personally see that your catalog gets rushed to you. John E. Thompson, President, NRI Schools, 3939 Wisconsin Ave., Washington, D.C. 20016.



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**"Gutsy up-hill pulling power,
thanks to a huge cut in backpressure.
That's what sold me on Turbo-Flow."**

Tests prove the Maremont Turbo-Flow CBQ muffler can add horsepower—about 14%*—when I need pull-power most.

That's because Turbo-Flow can keep backpressure to roughly half what it is with most other mufflers.SM And that can mean a freer-breathing, cooler-running, better-performing engine that gets me the most from every drop of gas.

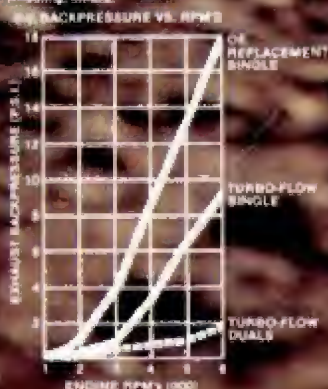
To top it all, Maremont Turbo-Flow sounds great. Not too loud, not too daring. It's the 100% legal purr that's just right for me and my vehicle.

Too many good reasons to resist. I'm sold on the Maremont Turbo-Flow CBQ muffler.

Available at leading autoparts stores, service stations and garages.

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Conducted by Prototype Engineering, Wheeling, Illinois.



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LETTERS TO THE EDITOR

For better panoramas

Taking photographs for panoramic shots is easy, as Tom Sahagian says (*Shoot Panoramas With Your Snapshot Camera*, page 104, Apr. '79), but far more so if correct techniques are used.

The problem of matching adjacent prints is reduced if:

1. The camera is mounted perfectly level on a tripod.

2. The camera is fastened to the tripod with the center of the lens directly over the tripod screw. This can be done with a flat strip of metal with two holes drilled and tapped, so that the camera bolts to the strip and the strip bolts to the tripod with the center of the lens directly above.

If the camera moves through even a small arc, truly craftsmanlike results are impossible.

JORMA HYYPIA
GREENWICH, CONN.

Perfectionists may want to follow Mr. Hyypia's advice. But if you are not inclined to carry a tripod or make an adapter plate, rest assured that perfectly acceptable results can be readily obtained with hand-held shooting. We shot without using a tripod.

Chemical benefits

I found *How Experts Are Defusing Rolling Bombs That Ride Our Rails* (page 57, Jan. '79) interesting, as did Ms. Wasserbach (*Letters*, page 7, Apr. '79).

However, Ms. Wasserbach states in her letter that, "There is no study anywhere defining just the amount of comfort chemicals add to our lives."

As an employee of a chlorine manufacturing facility I decided to do a small study of my own. The following facts may surprise even Ms. Wasserbach:

1. More than 90 percent of U.S. drinking water depends on chlorine for purity.

2. Almost all the textiles produced in the United States depend on chlorine and its derivatives in their production.

3. About three-fourths of the steel produced in the United States depends on chlorine derivatives in order to be processed into consumer goods.

These are only some of the exam-

ples of the many uses of this versatile chemical. I think an article on the manufacture and use of chlorine might help the public decide for itself if this chemical is "essential to our living."

DANNY MICHAEL
MUSCLE SHOALS, ALA.

Zoning vs. wheeled workshop

The article *Workshop Has Wheels, Will Travel* (page 127, March '79) was excellent. I did the same thing several years ago with a used mobile office trailer. However, many municipalities have zoning ordinances that prohibit such a trailer. It would be wise to check into this legal angle before investing in the project. Mine was built before the ordinance went into effect in my town.

JANE MILLER
CARSONVILLE, MICH.

Flipped out

I am interested in the Flip Grip II vise that appeared in the May issue (*PM Workbench*, page 42). Where can I purchase one?

S.H. FRITZ
VANCOUVER, WASH.

It is made by the Wilton Corp., 2400 East Devon Ave., Des Plaines, Ill. 60018, and should be widely available.

A tuner in Altoona

Thank you for *Tune In on the Airborne Action* (page 82, March '79). Now I finally know what I'm listening to when I tune these channels on my multiband portable. I appreciate the good, clear writing and understandable language for nontechnical types like me. I'd like to see more articles like this, please.

D.M. BECKER
ALTOONA, PA.

What's the connection?

In *How to Spot Trouble When You Inspect a House* (page 179, Apr. '79), you show an electrical junction box and say the lack of a Romex connector shows poor electrical work. The box shown does not use an external Romex connector; it uses an internal clamp to hold the cable. This can be seen through the hole on the left. I know because I do this for a living.

DOUGLAS L. DEARINGER
ANTWERP, OHIO

Oh, the ignominy of it all! The picture was taken in the author's house. When he went to correct the "problem," he noticed that the internal clamp was there. By that time, however, the presses were already rolling. Thank you for your keen observation.

Oil fired up

What do you think you are doing with the suggestion to discard used crankcase oil in the trash can (*Easy Oil Change, PM Garage*, page 24, Jan. '79)? Where do you think the trash goes except to the garbage truck, which in turn has a compacter, which crushes the trash, which leaks out onto the street, and then goes down the storm drain? It would help if everyone would try to solve problems, instead of adding to them, which is what you are doing.

W. BERNHEIM
OROVILLE, CALIF.

Until a more comprehensive program of recycling old oil is established, you should try to find a gas station that will take your oil. If that should prove to be a problem, it is much better to dump it all in one place (by putting it out for refuse collection) than discarding it illegally. If you are interested in obtaining a more complete treatment of this subject, you should see the PM story, World's Biggest Oil Leak, page 30, Sept. '76.

Saturday Mechanic helps out

I read *How To Stop Stalling* (page 128, March '79), and, just as you described, my car used to stall when I gunned it after stopping at an intersection. When I called my dealer, his reply sounded like he was reading straight out of your article. A new gas filter solved the problem. Thanks a lot.

LYNN OWEN
PERRIS, CALIF.

Correction

In our April article, *All About Siding*, we noted that a pamphlet entitled *Rigid Vinyl Siding Application* could be obtained from the Society of the Plastics Industry Inc. The address which we printed was an old one—the Society's current address is 355 Lexington Ave., New York, N.Y. 10017. We regret having caused anyone inconvenience. **PM**

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KOOL

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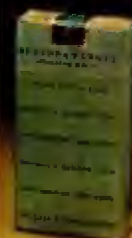
100's
LOW TAR • MENTHOL

Smooth taste in
Kings and "100's,"
both at only 9 mg. 'tar'.

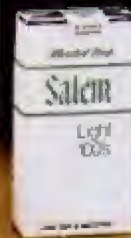
**At only 9 mg. 'tar,'
it's lower
than all these.**



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Warning: The Surgeon General Has Determined
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9 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

DETROIT LISTENING POST

Fighting to save diesels

The combination of proposed NOx and particulate (soot) emissions standards for diesel engines will kill the fuel-efficient powerplant that's been widely heralded as the savior of family-size cars, say the nation's automakers and some diesel-car importers. "Change the standards or forget the diesel," they are telling Washington regulators.

The first stumbling block is a 0.6 grams-per-mile (gpm) particulate requirement for '81-model cars that could put the larger diesels out of business after next year. Even smaller ones (like VWs) are not likely to meet the proposed 1983 level of 0.2 gpm. Why, they ask, are diesel passenger cars being singled out for such heavy regulation, when their relatively small numbers represent such a tiny percentage of the country's operating mobile and stationary engines?

Because of its tough 1980 NOx standard (1.0 gpm for all passenger cars), California may have no diesels in new-car showrooms after this year. GM has already threatened to pull out and both Mercedes-Benz and VW may do the same, even though California is presently the nation's strongest diesel market. And the Federal particulate rules would make things worse, since the technology used to control NOx tends to increase particulates.

Meanwhile, buyers fearing gas shortages and increased prices are snapping up existing diesel cars faster than they can be built, resulting in waiting lists for everything from diesel VWs to diesel Cadillacs.

Safety vehicle progress

Recent crash test of the Research Safety Vehicle (RSV), being jointly developed by Chrysler and Calspan, have shown occupant survivability in front, side and rear crashes to be in the 40-50 mph range. Based on Chrysler's Omni/Horizon, the RSV uses major structural changes, a heavily padded interior and a passive torso belt system that inflates on impact to protect its passengers. The next phase of development will involve construction and testing of 10 more of the Chrysler/Calspan cars, as stepping stones toward what researchers hope will be "a lightweight, advanced safety vehicle design, suitable for family trans-

portation in the 1985 time frame."

GM outlines future diet

How does the world's largest automaker reduce its average fleet inertia (EPA test) weight from 3500 pounds in 1978 to 2700 pounds by 1985, to meet the 27.5 mpg fuel economy standard for that year? First by redesigning and resizing every product line at least once, and in some cases twice. Second, by substituting lightweight (and higher-cost) materials for the traditional iron and steel in every possible way.

Use of aluminum in GM cars is programmed to increase from 108 pounds per car in 1978 to as much as 240 pounds by 1985, and plastics content will rise from 175 pounds to maybe 300 pounds in the same period. Steel use will fall simultaneously, from 2083 to about 1500 pounds and cast iron 573 to 350 pounds.

More Ford future products

Reports indicate that Ford has postponed plans to replace its Granada/Monarch lines with all-new front-drive cars in 1981, opting instead for a major facelift and resizing. Major emphasis is now being placed on preparing a brand-new line of smaller front-drive cars to compete head-to-head with GM's Citation-series X-body compacts. Known internally as the "Derby" cars, these Ford and Mercury entries are planned for 1982 introduction and will be stretched versions of the front-drive "Erica" models, slated to replace Pinto and Bobcat in 1981. A new V6 engine, also planned for 1982 introduction, will likely be a "Derby" option, as will a turbocharger option for the base 1.6-liter Four.

Big Plymouth on the horizon

Now that Chrysler Corp. has its nicely redesigned big Chryslers and Dodges in a competitive market position, Chrysler-Plymouth dealers want to increase their profitable big-car action with a Plymouth version. They'll get it next month. We'll have to call it "Big Plymouth" until we see the nameplate!

In spite of the ongoing emissions controversy, Chrysler also wants a piece of the diesel business. Diesel versions of the old 225-cu.-in. slant Six have been under development for some time and are described as "superb" by insiders... but it would

cost \$220 million to put that engine into production. Since corporate executives feel they could better spend that money on other projects, they'll likely purchase their diesels from Peugeot of France, when and if the decision is made to install them in light trucks and passenger cars.

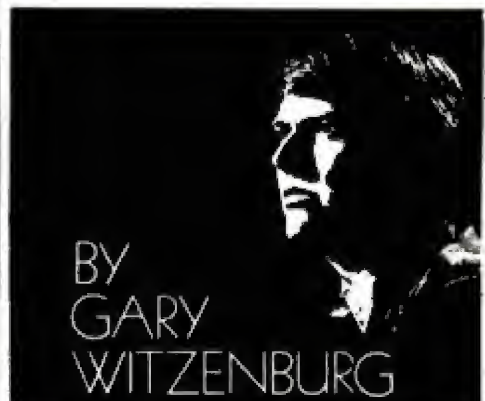
And then there is the very secretive sports car program with Alejandro deTomaso, the Italian exotic-car builder who teamed with Ford to produce the Pantera a few years back. Now that Lee Iacocca is Chrysler's president, he wants some exciting cars to boost the company's image, and he's hired deTomaso as a "consultant." The outcome will likely be a limited-production, customized and souped-up (turbocharged?) version of the Omni/Horizon coupe.

AMC to double Jeep output

American Motors plans to increase production of its popular four-wheel-drive Jeep line from 170,000 units in 1978 to more than 350,000 by 1981. This added output will help satisfy domestic demand, as well as the growing European 4wd market. There also have been discussions with a company in China about possible 4wd production there.

There is now a new lightweight, dealer-installed, tinted-glass sunroof available for Jeep pickups, Wagoneers and Cherokees. It flips up for ventilation or removes completely, and is priced at a fairly reasonable \$182.55, plus installation.

And speaking of sunroofs, American Sunroof has developed a new sliding-type design made with Corning photochromic glass that darkens in sunlight, but clears at night—the same type used in light-sensitive sunglasses. Pricing has yet to be determined, but the units should become available shortly. **FM**



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APPLIANCE CLINK

QUESTIONS ANSWERED

"Grayting" problem

Our Kenmore gas dryer is giving us a problem no one can pinpoint. Why is it that at times clothes coming from the dryer have a gray look? The machine has been dismantled and cleaned, vents washed out and the motor vacuumed. The serviceman doesn't have a remedy. Help!—J.H. Johnston, East McKeesport, Pa.

Staining material can come from one of three places: dryer, washing machine or clothing. The dryer possibility is remote. On rare occasions, excess lubricant placed on a drum support wheel in production may be transferred to clothing, but this would result in gray-looking clothes every drying cycle. You indicate that the problem is occurring "at times."

Staining material that is being transferred to clothing in the washing machine is more likely. Grease may be getting on clothes from the agitator shaft. In the drying process, heat causes grease to break down and spread, giving clothes a tattletale gray appearance. But, again, if this were the cause, it would occur more often.

The most likely possibility is that dingy clothing is the result of grease or oil adhering to clothes which are being put into the washing machine. The dirt is spreading during washing and drying. To eliminate this possibility, examine clothes before they are washed. Is someone in the family working at a job where grease or oil can get on or in clothes? By "in" I mean that pockets may contain grease spots put there by grease-covered hand cloths. Check on it and use spot remover if needed before washing.

Moving violation

We recently transported a refrigerator on its side and now it won't run. A serviceman told us that moving the unit in this manner has ruined it. However, we moved the same refrigerator on its side once before without adverse effects. Why then and not now?—Gregory L. Evans, Detroit.

The unit may not have been bounced around as much on your first move. The bouncing last time has probably damaged the compressor. If it weren't for the chance of physical damage, moving a refrigerator on its side wouldn't be a problem. Although oil may run out of the compressor into the condenser, this

won't ruin a refrigerator. Eventually, the oil returns to the compressor through the sealed system. It's that excessive bouncing that a refrigerator or freezer might receive while on its side or back that makes transporting a unit in this position dangerous. A compressor ruined by motion has to be replaced. That's expensive.

Flaky burner

At times our RCA Whirlpool Imperial gas dryer works without a hitch. Other times the pilot ignites, but the main burner fails to go on. Consequently, clothes won't dry. There's no pattern to the problem. It can happen at any time. We find that we may get an ignition with main burner follow-through after a few minutes, or at times immediately. At other times we may not get an ignition all day. This problem occurs at any dial setting for a timed cycle or at any selected dryness position. How do we stop it?—William Weimann, Torrington, Conn.

The cause of intermittent main burner ignition usually lies with the thermocouple, solenoids on the gas valve body or the gas valve. There are various kinds of ignition setups, but all work pretty much the same way. A glow coil heats the thermocouple. This heat is sensed by solenoids on the valve body, which permit the gas valve to open and gas to reach the burner.

Pinpointing the defective part requires testing with an ohmmeter. The thermocouple and solenoids can be replaced. If the gas valve is sticking, disassemble and clean the part. If the valve continues to stick after it's been cleaned, it should be replaced.

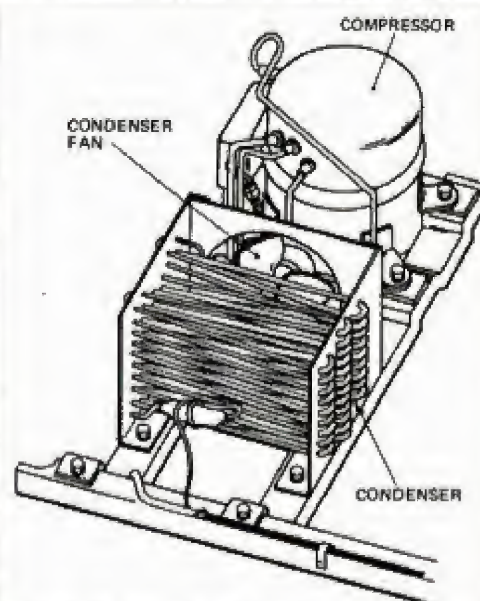
This work should be done by a trained technician. Call the gas company. Most have, or will recommend, a service department.

SERVICE TIP

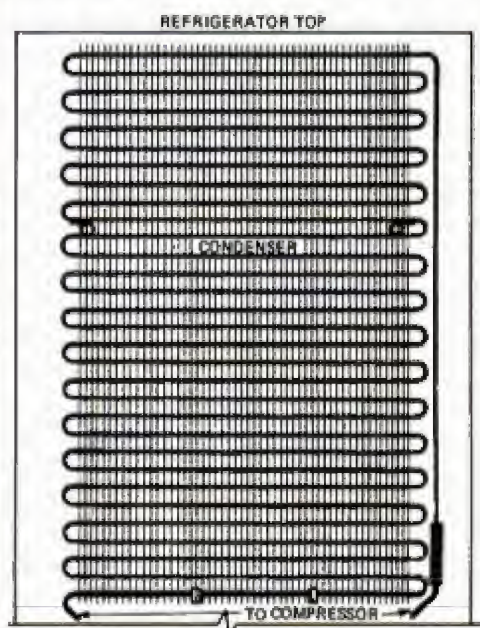
As a Frigidaire service technician, I have obtained many ideas and hints from your column. Now it's my turn to return the favor.

My phone doesn't stop ringing in hot weather. People call and complain that their refrigerators aren't cooling and want to know if I can come "right away." When I spend a few moments cleaning off a condenser, then hand the customer a bill, he or she screams, "Is that all that was wrong?"

Tell your readers they can save themselves a bill, and possibly spoiled food or a damaged



Forced-air system is under refrigerator.



Static system is at refrigerator back.

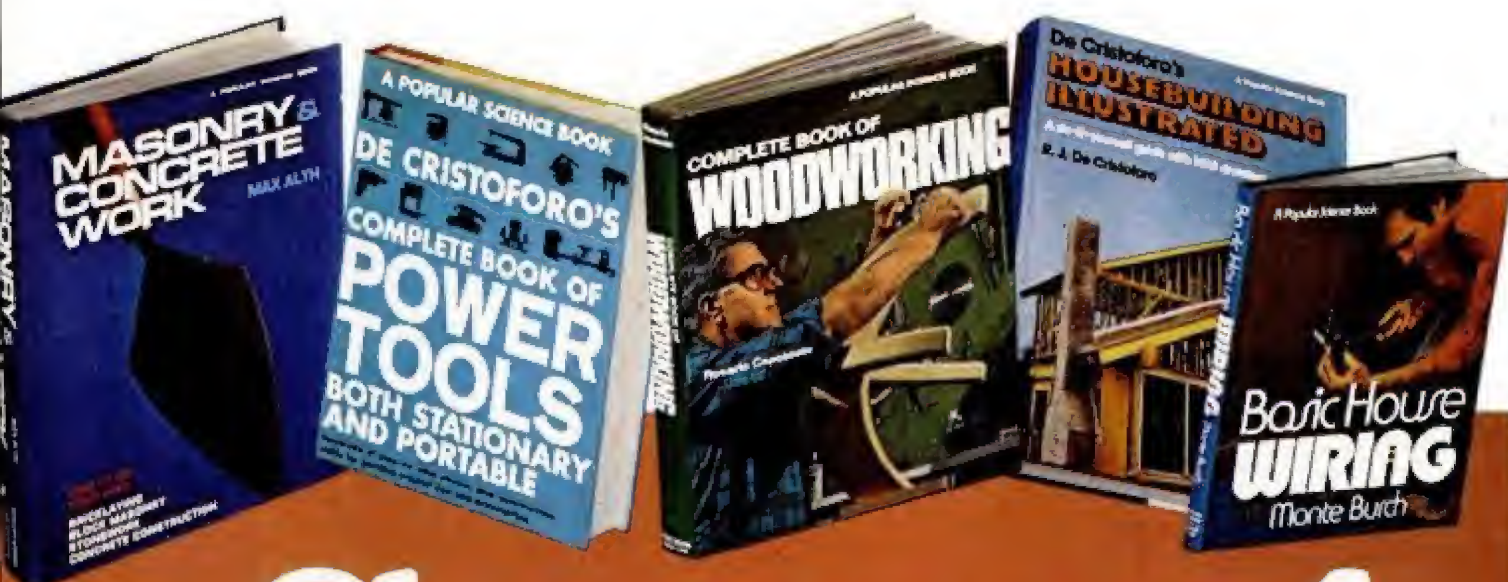
compressor, by cleaning condenser coils themselves. Coils are either static (tubes up the back of the refrigerator) or the forced-air type (fan and coils under the unit in the back). If you have the forced-air type, remember to clean fan blades, as well as coils, since dirt can keep blades from moving air effectively.

The best way to clean a condenser is with a portable air tank that blows coils clean. If you lack this equipment, use a vacuum cleaner and bottle brush. Don't use force or you may dent, bend or kink the coils.—Terry L. Neustel, La Grande, Ore.

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.



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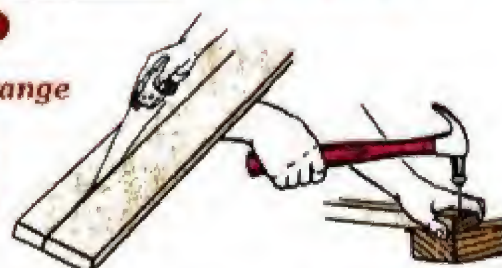


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HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Replacing laminate surface

The Formica laminate on my kitchen countertop needs replacing. Can the old surface be sanded sufficiently to glue on new Formica satisfactorily?—Marvin E. Davis, Tuscaloosa, Ala.

A laminated countertop can be covered only if you sand it sufficiently, removing all shiny surface. Use a medium-grit paper. Don't forget to sand any self-edges that may require re-covering. Dust, then wipe all surfaces clean with lacquer thinner. When resurfacing, apply two coats of contact adhesive on the sanded areas. Let the first coat dry thoroughly before applying the second coat. Make certain room is ventilated.

Footsteps overhead

I can hear noise from the apartment above me in the six-year-old building I bought. The floor above me is carpeted and has insulation between the joists. I was thinking of sandwiching 1/2-in. Styrofoam between my existing ceiling and an added layer of plasterboard. Do you think this would help, or should I learn to live with it?—Ronald Kucera, Calumet City, Ill.

There are two types of sound involved in apartment house construction: **impact noise** (measured by impact noise ratio, or INR), such as high-heel shoes on a tile floor, and **airborne noise** (measured by sound transmission class, or STC), such as voices, radios, TVs. You don't mention the type you're concerned with, but if properly installed your construction is slightly below a desired

STC rating of 50. The carpet helps attain the desired INR rating of 0, but under any uncarpeted areas (kitchens and baths) you're sure to hear noise.

Resilient channels are often used to deaden sound in initial installation. These are metal channels, screwed at right angles to the joists on 16-in. centers. The plasterboard is then screwed to the middle of the channel with special screws. Taping and jointing is the same as with a nail application. The channel is designed to cut down the transmission of sound through the wood flooring system. In your case, screw the channels to the joists through the existing ceiling. Use 1/2-in. plasterboard for the new ceiling.

Your local lumberyard should carry all the required items. Or look in a classified directory for nearest United States Gypsum (USG) dealer.

Damp concrete floors

How do we eliminate the cold dampness of the concrete floor at a lake cottage in Northern Michigan? We've heard that putting down plastic topped by hardboard would help solve the problem. Although we read your column, we've never seen this mentioned.—Jim Okuly, Saginaw, Mich.

Not only would it help, but if you then add carpet and pad, you will have it made. Remove the baseboard and carefully lay a minimum of 4-mil-thick polyethylene plastic on the floor, taping it at least 1 in. up the walls. Set your 1/4-in.-thick tempered hardboard so there is a mini-

mum 1/2-in. gap between it and all walls. Leave a 1/16-in. gap at joints.

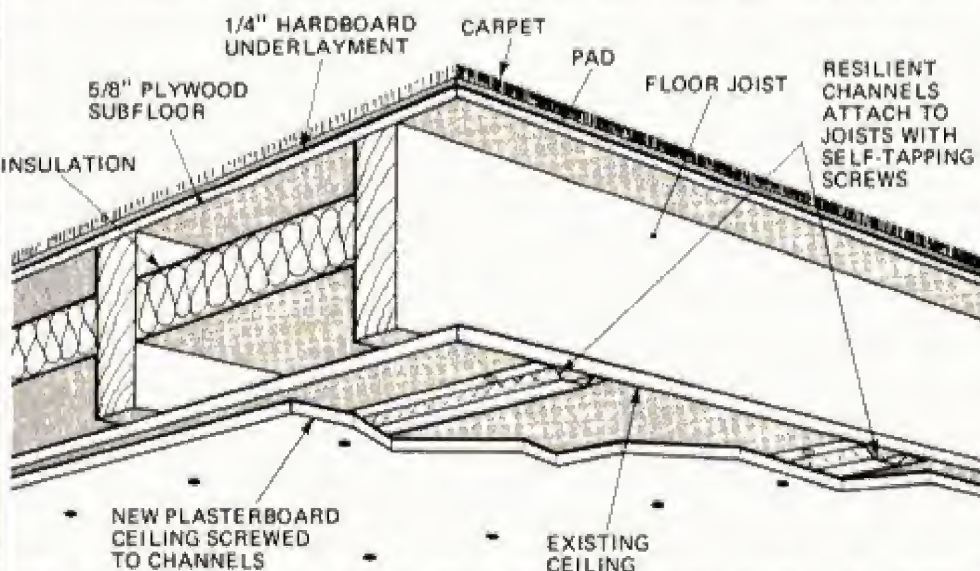
Fluffy growth

I have stone basement walls covered with cement. At some point, they were whitewashed. Now I get a cottony substance bubbling out on the insides of the walls. I wire brushed the walls. Then I applied a material that was supposed to stop the foaming and seal the walls. After a while, parts of the "sealer" dropped off and the cotton reappeared. Can this condition be corrected?—Anthony F. Bordogna, Bryn Mawr, Pa.

It can be corrected if you can keep your basement walls dry. Unless you're sitting on a well, you'll find that man is the cause of most damp and wet basements (see *Musty Basement*, May '78 *Homeowners' Clinic*, page 70). Your wall suffers from a chemical reaction between the water-soluble salts in the mortar and dampness from outside. This condition is known as efflorescence. It usually stops as the masonry dries.

If the wall is subjected to wetness, it will continue to "froth." Many of the stains may be scrubbed off with water. Heavy accumulations or stubborn deposits of white efflorescence salts may be removed with a solution of muriatic acid (1 part acid to 12 parts water) and scrubbing. Wear long sleeves, gloves and goggles. The wall should be saturated with water both before and after the solution is applied. Remember though, it will only be a temporary cure until you "dry out" your basement.

PM



Channel system, with a new layer of ceiling, will cut down much of the overhead noise.

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.





Why wait for Christmas?

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IMPORTS & MOTORSPORTS

VW blitz



A bigger behind marks Scirocco's shape for 1981.

If you think in terms of automobile model years, 1980 is already here. And if you know your VWs, you're well aware that penny-pinching Rabbits from Pennsylvania are only the spearhead of a rash of models from Volkswagen.

So, while the current models proliferate, lines start to form for the ragtop and existing lines grow longer for the Rabbit diesel, here's what's coming down the Autobahn from Wolfsburg for 1981.

The sporty Scirocco will get a



Notchback Rabbit will join the lineup.

boost in performance when the turbocharged model is offered next year. It seems sacrilegious to be monkeying with the lines of this little jewel, but there's already a Scirocco successor in prototype, as shown above. Certainly the new design, with its bigger windows and integrated roll bar, won't replace the current model before 1981.

Have you noticed the absence of hatchbacks in the Audi, BMW and Mercedes models here? Hatchbacks are for masses, you know. Distinguished persons drive formal-roof cars. Now, lo and behold, the maker

of the people's car is going after the snooty car market: VW is notchbacking the Rabbit. Code-named Hummel, the car will be seen here in 1981 and may be built in the Pennsylvania plant.

The Dasher, too, is slated for a more substantial revision than just the face-lifts it's had over the last few years. A sneak look at the five-door redo (below) indicates a roomier car, with a big increase in glass area.

New family car

There's no escaping fashion, and the family sedan is no exception. In recent years, the sporty sedans that have captured the imagination and inspired unabashed copying have been the European designs. Japanese automakers caught on, stopped imitating Detroit and now tout their versions with descriptions like "Eurocoupe."

The latest good-looker in the fami-



Mitsubishi Lancer is rear-wheel drive.

ly sedan category (coming right after Mazda's 626) is Mitsubishi's Lancer EX. Just introduced in Japan, the four-door is a handsome addition to the Mitsubishi lineup. It's a home-market car that we won't likely see here. A Lancer in Chrysler/



Roomier Dasher may offer a five-cylinder diesel engine.

Plymouth/Dodge showrooms would add to the mix of minis and further confuse a car buyer who faces an array of Omnis, Horizons, Colts and Champs in various body styles and drive trains. For some help in getting them sorted out, see the Owners Reports on page 52 and 72.

High-speed sleeper

Before Pete Schmidt took his one-ton pickup out on the Bonneville Salt Flats and clocked 132.502 mph, he removed his family's custom sleeper module from the bed and installed an aerodynamic wing—had to keep the rear wheels on the deck, by gosh. His mph is a new world



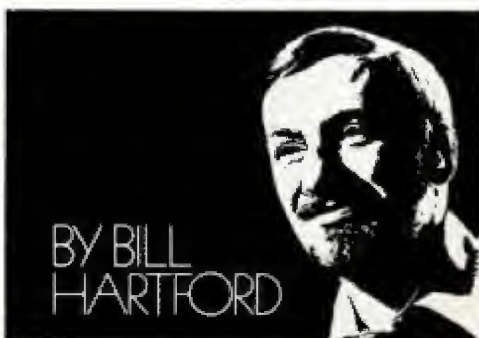
132.502 mph! Who said diesels were slow?

speed record for Class C diesel trucks . . . that's right: *diesel*.

The tradeoff of mph for mpg with a diesel powerplant wasn't for Pete, so he did a little work on his 210-hp, 318-cu.-in. V6 Detroit Diesel. Twin AiResearch turbochargers and high output fuel injectors more than double the hp. He hit his record speed while the engine was turning a leisurely 3700 rpm.

Popularity of the diesel couldn't be higher right now. Its fuel efficiency still amazes us: We recently ran a Dasher diesel ragged in urban and suburban driving and still got 40 mpg. Mpg is the real advantage, now that diesel fuel costs about the same as gasoline.

Another diesel engine just arrived on the scene—Audi's five-cylinder, optional in the 5000. We drove it recently, will report next month. **PH**



BY BILL HARTFORD

THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Torx fastener sockets

Torx-head screws are coming into wider use on late-model cars and trucks, particularly GM models. The star-shaped, six-sided head is most widely used in internal versions, although external Torx heads also are available. You'll find Torx screws on door strikers, seat-belt hardware, bumper mountings, door hinges, windshield wipers, headlamp bezels,



Torx screw set comes with nine bits.

front stabilizer bars and in some transmissions.

The internal Torx head, like the Allen, permits greater tightening of a roundhead screw than would be possible with a slotted head, even slightly more than with the Allen type. If a Torx-head screw isn't too tight, you can remove the internal type with an Allen wrench. A better idea, however, is to get a set of socket wrench bits that fit Torx screws. Until recently, about all you saw in parts stores were inserts for socket wrenches, but now you can get a complete set of Torx bits. One of the best sets we've seen has nine sizes on a convenient bar with leaf spring retainers. List price is \$30. It's made by Owatonna Tool Co., Owatonna, Minn. 55060.—Paul Weissler

Magnetic parts tray

Everyone has his favorite holder for the screws, little parts, sockets and so forth that he's using on a job. It may be an old hubeap, a cigar box, or something like that. It remains a favorite until you knock it over and the parts go scattering all over the garage floor, some of them never to be found again. Now you can acquire



Magnetic tray holds onto auto parts.

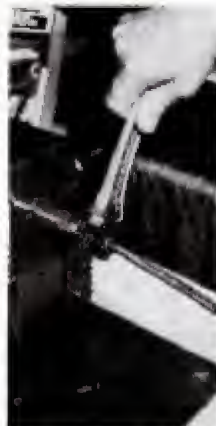
a new favorite for about \$5, a magnetic tray. Not only does the tray hold all steel or iron parts, but the tray itself holds to any steel or iron part of the car, and at any angle. If you accidentally bump the tray while working, the tray will just hang there, and the parts will remain inside. It's made by Thexton Manufacturing Co., 7685 Parklawn Ave., Box 35008, Minneapolis, Minn. 55435.—B.H.

Chain wrench

There are lots of chain wrenches around, but a new one caught our eye and, when we tried it, our fancy, too. It has two working surfaces—a smooth side and a toothed one. The chain has five links, and regardless of the side used, it doesn't seem to damage threads. We also used it around hex surfaces, and in one case counted 18 teeth locked against the flats of the hex. We wrapped it around the smooth side and all six sides were enclosed tightly by the chain. The head of the wrench shank is contoured, so you can use the wrench to loosen or tighten on both toothed and smooth sides.

This wrench is made in four sizes, but the C-8 (8-inch shank) seems to be the best choice for automotive work and such household chores as removing sink traps. It lists for \$17.50, but discounts are common. The maker is Grip-It Corp., Box 130, 3612 Old Philadelphia Pike, Intercourse, Pa. 17534.

—Paul Weissler



Chain wrench has two working sides.

Offset extensions

A professional mechanic needs many specially shaped wrenches to reach otherwise inaccessible nooks and crannies on the modern automobile.

Wouldn't it be great if you could buy just one wrench that you could reshape at will to handle any accessibility problems? This hasn't been invented yet, but something very close is on the market, and it's a real budget-saver.

For just \$11, you can buy a pair of curved, horizontal extensions that plug into any $\frac{3}{8}$ -inch-drive ratchet wrench, socket and vertical extension. The horizontal extensions can be used individually or locked together into 18 different shapes. If you interpose vertical extensions of different lengths on or between them, you can form a wrench shank that should clear just about anything.

I hooked the two of them together with a ratchet and socket to reach



Curved extensions let you do impossible.

cooling-fan bolts. I used one of them, plus a very short vertical extension between it and the socket and a medium vertical extension between it and the ratchet, to reach a rear sparkplug. I then switched this latter setup around (socket on the medium vertical extension, ratchet on the short one) to reach a virtually impossible rocker-cover screw.

The pair, made by Thexton Manufacturing Co., 7685 Parklawn Ave., Box 35008, Minneapolis, Minn., 55435, is No. 343 and is called $\frac{3}{8}$ -inch Ratchet Offset Extensions. The tool is available at auto parts stores.

—Paul Weissler

GREAT GOING, PONTIAC!



NO FULL-SIZE CAR SOLD IN AMERICA GETS BETTER ESTIMATED EPA GAS MILEAGE THAN THIS PONTIAC.

You simply can't buy a full-size car in this country that gets a better EPA *estimated MPG* than our '79 Pontiac Catalina. In EPA tests, Catalina chalked up impressive estimates.

18 27

EPA ESTIMATE MPG HWY ESTIMATE

Remember: Compare the circled *estimated MPG* with that of other cars. Your mileage may vary depending on speed, trip length and weather. And your actual mileage will probably be less than the highway estimate. Your mileage will also be lower in California.

What's more, the *estimated MPG* figure is 38% better than just a few years ago. (Percentage increase less in California.) That's comparing '76 and '79 Catalinas equipped

with standard engines.* Rather impressive.

Especially when you consider what Catalina offers. More headroom. More rear legroom. More passenger and luggage volume overall than its '76 counterpart. Now that's more Pontiac.

Handsome appointments. Like standard full-width seats. Simulated regal walnut on the instrument panel. New trim. New fabrics.

Many more available features. From Rally RTS to wire wheel covers to nine different sound systems.

Plus trim new styling that we think makes this the smartest looking Catalina ever and your smartest full-size buy of the year. Test-drive one soon.

*Catalinas are equipped with GM-built engines produced by various divisions. See your local Pontiac dealer for all the engine details.

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MADE IN CALIFORNIA

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The satisfaction of Camel Lights 100's solves the low tar/low taste problem. With an exclusive Camel rich blend specially formulated for smoother, longer length smoking. No other low tar 100 can match it for taste.



New 100's Kings

LIGHTS: 9 mg. "tar", 0.8 mg. nicotine, LIGHTS 100's:
13 mg. "tar", 1.1 mg. nicotine, av. per cigarette by FTC method.



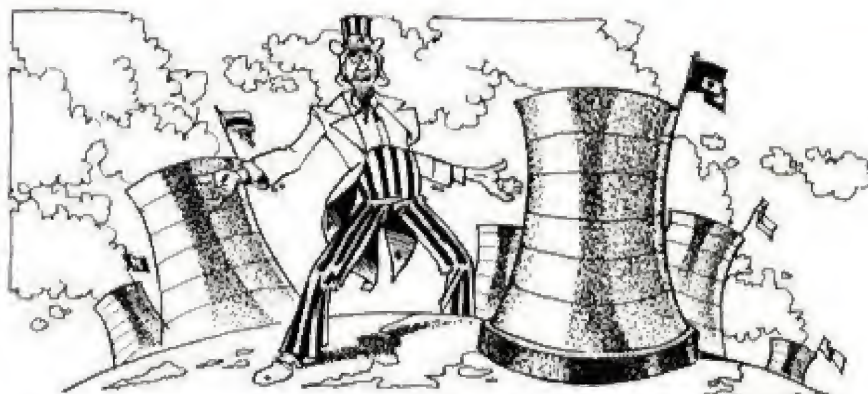
Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

The atomic planet

There were some peculiar reactions to the series of foul-ups, breakdowns and misinformation that combined to create what will always be remembered as this country's first major "nuclear accident" at Three Mile Island, Pa. The most peculiar came from overseas.

The Russians, for instance, claimed there never was a serious or life-threatening incident at the Pennsylvania powerplant. Instead, claimed Moscow's top nuclear power scientist, "the big American oil companies" had created the whole thing as a conspiracy to discredit nuclear reactors as power sources and enhance their energy monopoly. Some other countries also played the situation down; the French government's reaction to an attempted sabotage at one of their reactor manufacturing plants was simply complete censorship of the details.

The point should not be lost on the American public: Whatever the place



we decide nuclear power should have here, some other countries are determined to develop it full bore.

The ridiculous oil cartel conspiracy theory that constituted the major Soviet response to Three Mile Island was seen by experts as a move to squelch any uneasiness at home. A growing body of evidence suggests the Russians kept the lid on details of a nuclear catastrophe in Siberia some 20 years ago that involved the explosion of radioactive fuel with mass contamination and loss of life. But their commitment to building

many more reactor powerplants—including the plutonium-creating "breeder reactors" the U.S. considers far too risky at this stage of the game—is massive and unwavering.

The question we have to ask is: If atomic power will proliferate the world over whether we like it or not, who is going to "police" the individual national systems or technologies to make sure they are safe?

The answer right now is *nobody*. And this planet's too small a place for that kind of answer to be acceptable.

Longevity in the skies



First workaday Skyhawk . . .
. . . and later with Blue Angels.

In the thankful absence of all-out shooting wars, military planners have to be given credit for something, and a lot of people think a good place to start—and linger awhile—would be cost efficiency. That being the case, the loudest possible peacetime salute should be fired off in honor of the McDonnell Douglas A-4 Skyhawk, a rugged, bantamweight attack aircraft that has recently gone out of production.

Why care about an obsolescing airplane? Because the production run of the Skyhawk, which began in 1953, was the longest ever for any U.S. military aircraft. With a wingspan of only 27.5 feet, the A-4 was initially designed for compact stowage aboard aircraft carriers, and had an empty weight of about 10,400 pounds. But its survivability and ability to carry all manner of tactical ordnance soon got the Skyhawk "enlisted" by the Marines for close air support from forward airfields.

Its straight-ahead speed, in the high subsonic range, was not intended as the A-4's big stick, although it briefly held, in 1955, the speed record for 500 kilometers around a 100-km

closed course—averaging 695 mph some 300 feet off the deck. But with a retrofit Pratt and Whitney engine putting out 11,200 pounds of thrust, the stubby little bird was lively enough for anybody, and was drafted by the Navy's Blue Angels demonstration team.

The Skyhawk is currently a frontline aircraft, in one or more of its 17 different model manifestations, for half a dozen of the world's national air forces. Though no longer manufactured, it will undoubtedly still be flying somewhere in uniform when the century turns. And many a Pentagon budgeteer may shed a nostalgic tear on its behalf.



PM's Whatsit

If you're mechanically astute, you should be able to figure out what's going on at this petroleum storage center near Bournemouth, England. Though the conclusion may astound you, the visual clues all add up to one thing. Want to clear the air? Turn to the next page.

BRIEFS

Son of shank's mare

Surveying the alarming tally of approximately 30 joggers that have been killed by automobiles within the borders of their state, the legislators of



New Jersey recently began hearings aimed at producing the first special laws to protect the growing ranks of human roadrunners.

Some Garden State lawmakers, however, were less than optimistic about drafting a pioneer statute that would be fair to all parties, biped or quadruwheeled, in the War of the Right Lane. "Some of these accidents apparently happened because joggers are arrogant," said one assemblyman. "They don't consider themselves pedestrians."

This haus is not a home

To be quite brief about it, an insurance company in Munich, West Germany, got involved in appraising the esthetics of its fair city. Eyesore number one was the "quite awful blank wall" of a house at 28 Frauenstrasse. The solution arrived in the form of American artistic designer Richard Haas, who created what you see here, just as he has done in Chicago, New York and San Francisco.

This kind of thing is usually called *trompe l'oeil* (French for "trick of the eye") in the art world. The sponsor, Deutsche Lloyd Lebensversicherung, is so delighted it wants to back other projects on other blank walls.

Our advice: Get to Europe this year while you can still see it.



Whatsit revealed



In extending the "hovercraft" principle, British Army engineers are able to move massive gasoline tanks around by fitting them with a rubber skirt that is inflated, lifting the tank on an air cushion. In the demonstration photographed, a 300,000-gallon tank was towed 100 yards to a new position by light vehicles. Air pressure of only half a pound per square inch is sufficient for "hovering" even great weights. It is a great time-saver over disassembly and reduces fire hazard to a minimum. (In this photo, the skirt has been deflated.)



SEARS SUPER VALUES

CRAFTSMAN 10-INCH TABLE SAW

Here are super savings on Sears Best 10" Table Saw (#29803) that miters, bevels, rips, cross-cuts and more. Outfit includes leg set, two extensions and a powerful induction run 1 HP motor that develops 2 HP. Plus, Sears exclusive Exact-I-Cut feature that lines up the cut ahead of the blade. Table Saw comes partially assembled. Regularly \$379.95.

CRAFTSMAN 10-INCH RADIAL SAW

Here's another great value on America's best-selling radial saw (#1977) that crosscuts, rips, miters, bevels and more. Has a powerful 1½ HP motor that develops 2½ HP. And a single lever miter arm control for one handed single step operation. Leg set sold separately. Regularly \$379.95.

YOUR CHOICE
\$279⁹⁵



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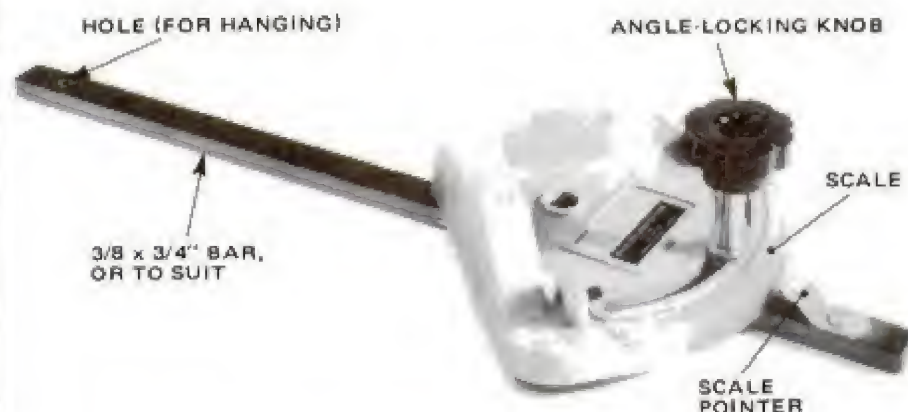
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PM LOOKS AT TABLE SAW MITER TOOL



Device is inserted in table's miter gauge groove and a square is used to align one face at 90° to blade. Adjust pointer, if necessary, and lock the knob.

The big advantage that the Perfect Miter has over a conventional miter gauge is that mating miter cuts can be made with the same setting. To cut second miter, just switch tool to second groove, as in photos. The tool is especially handy for one-of-a-kind jobs, such as unusual angles. It is lightweight and easy to adjust and use. It comes with a bar sized to suit grooves in most table saws ($\frac{3}{8}$ in. deep by $\frac{3}{4}$ in. wide); if grooves on your saw vary, let manufacturer know exact size desired and bar will be custom machined. Perfect Miter is \$32.30 postpaid from Nationwide Manufacturing Co. Ltd., Box 457, Edmonton, Alta., Canada T5J 2K1.—H.W.



To make a crosscut, hold the work and miter device as shown; use slow feed.



Miters can be cut left or right of blade. Hold the setup as shown here.



To cut mating miter, put device in right-hand groove and change hand grip.



When adjusted and used properly, the tool cuts on-target angles every time.



THE WILDERNESS IS SECOND NATURE TO OUR WAGON.

Until now, the station wagon's place was near the home. Sure it was great for picking up the kids and shopping. But when the going got tough, the station wagon didn't have what it took to get going: four wheel drive.

Our remarkably inexpensive Subaru wagon, on the other hand, is like having two cars in one.

Besides full-time front wheel drive, at a flick of a lever from inside the car, it swings right into four wheel drive. Something that makes our wagon at home even when it's far, far away from home.

What's more, the Subaru 4 wheel drive wagon has plenty of room and delivers great gas mileage. An estimated 34 highway mpg and 25 estimated city mpg using lower cost regular gas. (In Calif., it's 32 estimated hwy. and 21 estimated city mpg using unleaded)*.

We look at it this way. There are times you want to get away from it all. Shouldn't your station wagon go with you.

**For your nearest Subaru dealer
call 800-243-6000 toll free.**

*1979 EPA estimates for our 4 wheel drive vehicle. Use estimated city mpg for comparisons. Your mileage may differ depending on driving speed, weather conditions and trip length. Actual hwy. mileage will probably be less than hwy estimate. Actual city mileage will be less in heavy traffic. In Calif., call 1-800-882-6500. Continental U.S. only.
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SUBARU WE'RE CHANGING THE FACE OF



PM ELECTRONICS MONITOR

Marathon for man and computer

Ever hear of high school students requesting a 200-hour course (with overnights) in anything—with the possible exception of sex education? Well, in San Antonio, Tex., 370 students requested—and were granted—permission to conduct a marathon computer training course.

Radio Shack loaned 23 TRS-80 computers, the students brought sleeping bags and rounded up a few tireless instructors, and they were off and computing. Though students attended in shifts, during the eight-day event at least two computers were always in service.

When the grueling course ended, more than 70 students were accredited as having passed. They have requested listing in the Guinness Book of World Records, but that volume so far has no category for computer marathons. Even so, it was a more rewarding and appetizing venture than swallowing goldfish.

Tomorrow's computers

You may soon be able to order something from your favorite store simply by reaching over and touching a picture of the item right on the



Touch-sensitive overlays like this one may bring computer terminals in more homes. Just touch it to talk with the computer!

screen of your home TV. This is not as farfetched as it may sound.

Elographics Inc. has announced a "transparent position sensor." It is a clear overlay designed to fit most computer displays and resembles nothing so much as an old, Winky-Dink screen.

Only vague blurs in the transparency hint at the contacts inside the thin sheet. Yet, once touched, it can tell a computer exactly where contact was made.

Suppose you wish to order a watch from a computer equipped with such a device. You might simply press the

Resistor scorecard

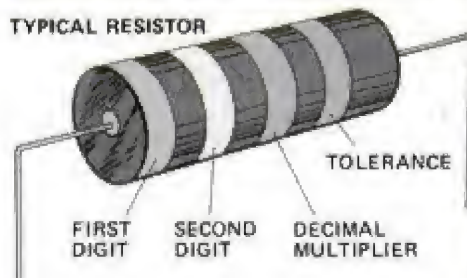
Just as you can't tell the players without a scorecard, you can't tell one resistor from another if you don't know the resistor color code. Almost all resistors available today are identified by four bands of color on their cylindrical bodies. The code is given in the chart at right.

So, if you have a resistor that reads brown-black-red-gold, you are looking at a 1000-ohm (1K) resistor with a tolerance of 5 percent.

The first band signifies the first digit in ohms (brown-1); the second refers to the next digit (black-0) and the third is the decimal multiplier (red-100). Thus, a simple calculation ($10 \times 100 = 1000$) gives you the value. The fourth band (gold-5) is the tolerance expressed in percentage.

Awkward at first, the table soon becomes second nature to the electronics hobbyist. Just remember that the first two bands show you the digits of a two-digit number and the third band tells you the figure by which to multiply the two-digit number.

TYPICAL RESISTOR



Color	Figure	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	—
Red	2	100	—
Orange	3	1000	—
Yellow	4	10,000	—
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	100,000,000	—
White	9	1,000,000,000	—
Gold	—	0.1	5
Silver	—	0.01	10
No band	—	—	20

picture of a watch shown among other items in an index array. Then the screen would show you different watch styles to choose from and you would touch the watch that best suited you.

Though the Elographics device is still very expensive, it—and others like it—may well prove to be touchstones for the future.

Dial 911 and live!

The emergency 911 number, which now serves 800 communities and more than 50 million people, has received much adverse publicity lately due to slow responses. Though better than no system at all, the 911 number has always been plagued with shortcomings.

Now, Western Electric and Bell Telephone have announced a new "Expanded 911" service. One of its most interesting features is that an operator seated at a console will see a digital readout of the phone number of the calling party. (Technology similar to this was previewed in Aug. '78 PM: *Instant Tracing System Shows You Who's Calling*, page 16.)

Once the phone number is displayed, it is a quick matter to cross-reference it to the party's address. This solves the problem of a victim unable to give his address or of a panic-stricken relative or friend giving garbled instructions.

The new 911 service also calls for decentralized dispatching. Instead of a call being sent to a main office, the Expanded 911 system will elec-

tronically route the emergency call to a dispatcher in the victim's own suburb or town. Help can arrive a few critical moments sooner and more lives can be saved.

Bell System planners estimate that up to 125 of these new 911 systems will be operating by 1985. Cost, and the time it takes to install them, will keep them from coming on-stream sooner.

Round and round she goes . . .

Sony started out as a small Japanese manufacturing firm exporting a percentage of its output to the United States. As the demand for Sony products here grew, the company began to export more and more, and the United States became a major factor in the profit and loss statement. As it grew into a giant corporation, Sony set up manufacturing facilities Stateside. They continued to grow.

It had to happen sooner or later. Sony recently announced that it will begin exporting its American-made goods to—of all places—Japan. **PM**



'I didn't sacrifice great flavor to get low tar.'

"The first thing I expect from a cigarette is flavor. And satisfaction. Finding that in a low-tar smoke wasn't easy.

"But then I tried Vantage. Frankly, I didn't even know Vantage was low in tar. Not until I looked at the numbers.

"That's because the taste was so remarkable it stood up to anything I'd ever smoked.

"For me, switching to Vantage was an easy move to make. I didn't have to sacrifice a thing."

Peter Accetta

Peter Accetta
New York City, New York



Vantage

Regular, Menthol and Vantage 100's.

FILTER 100's: 10 mg. "tar", 0.8 mg. nicotine, FILTER, MENTHOL:
11 mg. "tar", 0.8 mg. nicotine, av. per cigarette, FTC Report MAY '78.

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"How to shut out Athlete's Foot."

by Jim Palmer



"When I use Dr. Scholl's Solvex® Athlete's Foot Products, my athlete's foot doesn't even get to first base."

If you see it starting up, just apply Dr. Scholl's Solvex Ointment or Athlete's Foot Spray. Solvex kills fungi on contact. Helps control the itching, peeling and other irritations of athlete's foot.

Of course, a good defense against athlete's foot is applications of Dr. Scholl's Solvex Athlete's Foot Powder. It absorbs the moisture where fungus grows and helps prevent reinfection.

"I always keep Dr. Scholl's Solvex handy now. Let's face it, a ball player depends on his feet. And who knows more about feet than Dr. Scholl's?"

Dr. Scholl's



PM LOOKS AT HOSE REPAIR ITEMS



Quick fix for ruptured garden hose: To install Turn-Clamp, cut out damaged part of hose, insert hose ends into coupler and turn outer ring to clamp.

Here are two products that ease repairs on garden hose. The Turn-Clamp hose repair coupler (above) repairs leaking hose. Cut out the damaged section, push the hose ends into the coupler and hand-tighten the outer cylinder until it clamps securely. The clamp is available to fit $\frac{1}{2}$ and $\frac{3}{8}$ -in. i.d. hose, \$1.50 per coupler postpaid from Rovala Inc., Box 6493, Fort Worth, Tex. 76115.

The Easy-On Coupling series in hardware and lawn/garden centers includes: male end, shown below (\$1.33), female end (\$1.44) and hose mender (\$2.19) for leaks. Two sizes fit all hose. H.B. Sherman Manufacturing Co., Battle Creek, Mich. 49014.—P.A.



Insert Easy-On brass coupling end into hose, slip on nylon clamp and tighten screws. They can be loosened and coupling removed for another use.

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Treasure Detector

A new computerized metal detector that actually selects treasure from trash may uncover America's long lost relics and precious metals.



The new breakthrough in metal detectors makes finding treasure much easier.

There's a lot of treasure right under our feet. There's also a lot of garbage.

And the problem with most metal detectors is that they're dumb. They can't tell treasure from trash.

The new Techna metal detector is different. It has both a sensing system and a brain that can tell the difference between a foil gum wrapper and a coin—between a bottle cap and a diamond ring.

The new breakthrough was made possible by the use of a "discriminator IC"—a computer-type integrated circuit that can compare the ferrous and non-ferrous relationships that distinguish treasure from trash.

There are discriminator-type metal detectors now on the market, but they cost between \$170 and \$400. And no matter what price you pay, the detector is usually difficult to operate.

The new Techna Discriminator represents several breakthroughs. First, it is inexpensive—only \$69.95. Secondly, it uses a new (patent pending) phase compensation system of metal detection, whereas other discriminators use either the off-resonance or inverse discrimination principle.

This system utilizes a microprocessor circuit which replaces the conventional electronics, mode switch, and multiple tuners that added to the cost and weight of a discriminator unit.

Finally, the Discriminator is very easy to operate and understand. You simply set it to sense treasure, trash, or both and it automatically tunes itself and starts operating. Whenever you scan treasure, a loud speaker will emit a sound and you start digging.

DETECTORS ARE BIG BUSINESS

Metal detectors are big business. When we investigated the field, we discovered an entire new sport—treasure hunting. Treasure clubs exist and conduct contests. There's a national magazine and an association, and hundreds of thousands of units are in use every day.

Treasure hunting doesn't just mean looking for buried pirate chests. There's great interest now in discovering articles of historical significance such as old coins, military buttons, and old pistols.

Long ago when people distrusted banks, they buried their valuables somewhere on their property. If they died suddenly or became

senile, their treasures were lost forever. Many treasure hunters are now visiting ghost towns or going through older sections of cities looking for both historic and valuable articles.

WORLD WAR II STARTED IT

Metal detectors first saw extensive use during World War II. Back then, they were called mine detectors and were used to uncover enemy land mines. They were heavy, often weighing hundreds of pounds, and had to be carried on the backs of soldiers along with separate and heavy power supplies.



The Techna Discriminator is light and easy to operate with only two controls to adjust.

The new Techna Discriminator is light. It weighs only 2½ pounds and is powered by two readily-available 9-volt batteries. As you glide the sensing head over the ground, the unit remains silent until it uncovers a precious metal or whatever type metal you are searching for. An electronic sound is emitted. Then just dig in the area of the sound.

If you already own an expensive metal detector, you know that most of your "discoveries" turn out to be bottle caps or gum wrappers. With the Techna, you discover just what's worth digging up. While others are digging up bottle caps, you're covering more ground faster and are more likely to discover something worthwhile.

BREAKTHROUGH PRICE

The fully computerized Techna Discriminator is available from JS&A for only \$69.95 complete with batteries and all components. We suggest you order one just to try it out. Try it in your back yard. Take it to a sandy beach

where many coins and jewelry are lost. See how the system can tell the difference between treasure and trash, and then after you have discovered the fun of treasure hunting and how advanced this new product really is, decide whether or not you wish to keep it.

If you feel the Techna Discriminator does not meet all your expectations for any reason, we will gladly accept the return of your unit within our 30 day trial period and even refund your \$3.50 postage and handling. If you decide to keep your unit, you will own the world's most advanced metal detector. No competitive model even comes close.

Techna is America's largest manufacturer of metal detectors in the United States, and JS&A is America's largest single source of space-age products—further assurance that your modest investment is well protected.

Each Techna detector is backed by a solid one-year parts and labor limited warranty. We doubt if you'll ever have a problem with the unit because of its solid-state construction, but if service is ever indeed required, Techna's service-by-mail center will fix your unit and have it back to you quickly.

To order your Techna Discriminator detector, send your check for **\$69.95** plus \$3.50 for postage and handling (Illinois residents please add 5% sales tax) to the address shown below. Credit card buyers may call our toll-free number below. We will promptly send you your Techna detector with batteries, 90-day limited warranty, and instructions.

Why not join the legion of treasure hunters worldwide with the world's most advanced space-age metal detector. Order the Techna Discriminator metal detector at no obligation, today.

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SCIENCE WORLDWIDE

A pill for radiation

A pill to fight an effect of radioactivity from a damaged nuclear powerplant may soon be sold over the counter. The U.S. Food and Drug Administration has received dozens of inquiries from drug companies and others about potassium iodide, which counters the effects of some radiation on the thyroid gland.

Interest in an antiradiation pill has risen in the wake of the accident at Pennsylvania's Three Mile Island reactor in March. During that crisis, the crippled nuclear plant spread radioactive iodine 131, a byproduct of the nuclear process, over the surrounding countryside. When this isotope is inhaled or ingested, it can remain in the thyroid gland long enough to result in serious radiation damage.

Taken as a pill or as drops, potassium iodide blocks more than 90 percent of radioactive iodine uptake by saturating the gland. A dose of 130 milligrams (mg) of the drug at the time of exposure (65 mg for children under one) offers high protection; a daily dose during a crisis maintains the saturation.

The FDA announced last December that it would accept applications from companies wishing to market potassium iodide over the counter. At press time, an FDA spokesman said no applications had yet been approved, although the agency is on record as encouraging applications.

Potassium iodide has been safely used for years to treat asthma and other disorders. Doctors cautioned, however, against drinking iodine, a poison, or eating large amounts of iodized salt. Doses must be carefully limited for safe use, they said.

Tornado in a tank

Purdue University scientists are creating miniature tornadoes in a laboratory to study the immense destructive forces in real twisters.

Prof. John T. Snow, who designed the simulator with Profs. Ernest Agee and Christopher Church, said it could model even the severest tornadoes, such as the one that struck Wichita Falls, Tex., in April, killing 45 persons. "We're only just beginning to realize the complexity of tornadoes," Snow told PM. "For instance, in some very intense events—with winds up to 300 miles per hour—the direction of the air motion in the center is *downward*, not upward, as the air movement



Purdue simulator makes model tornadoes; twister (above, right) is 4½ feet high.

tends to go in simpler tornadoes."

The tornado tank draws air in through a lower chamber, whips it into motion with a screen and pulls it through a small hole in the floor of the main chamber. Artificial fog makes it visible.

The Purdue work could improve tornado prediction and lead to new construction requirements in vulnerable areas.

Tracking cancer in mummies

A University of Michigan pathologist has found no trace of cancerous tumors in ancient Egyptian mummies.

The laborious analysis of body fragments by Dr. Michael R. Zimmerman supports his hypothesis that today's environment is largely responsible for a high incidence of cancer deaths—about 20 percent of all deaths, according to the American Cancer Society.

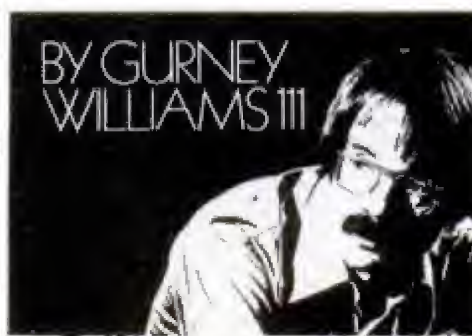
But Zimmerman said that so far he has examined only about 50 mummies, far short of the 100 to 200 required to draw statistically valid

conclusions. A spokesman for the American Cancer Society noted that cancer was not unknown in ancient Egypt. One papyrus dating from 3000 B.C. describes patients with breast lumps for whom "there is no hope."

Hammering out hydrogen

Using a diamond anvil—a device to produce pressures of millions of pounds per square inch—Carnegie Institute scientists are moving closer to making metallic hydrogen.

Dr. Peter M. Bell says his lab has created a new yellowish solid by applying pressure to liquid hydrogen. Researchers have increased the pressures on small samples of the solid—a crystalline substance like salt—to more than 700,000 times the sea-level pressure of the Earth's atmosphere. And that's closer than ever to pressures at which, theoretically, hydrogen will become metallic. If it can be manufactured, metallic hydrogen would be an efficient, pollution-free fuel, some 25 times more explosive than TNT. **PM**





The rugged beauty of the American west is a natural setting for these new Smith & Wesson Model 1500 centerfire rifles. Their smooth, flowing lines bring a new dimension to bolt action design. The natural warmth of hand-rubbed American walnut flows smoothly into the lustrous blue and sparkling chrome of metal. You can see the beauty and quality of these new rifles. But you'll have to visit your dealer to feel their near perfect balance. And shoot them to experience Smith & Wesson accuracy. In popular-calibers. Deluxe (Magnum, foreground) and standard versions. Smith & Wesson, 2100 Roosevelt Avenue, Springfield, Massachusetts, 01101.



Smith & Wesson

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THE WAY IT WAS, IS THE WAY IT IS. EARLY TIMES.



1870. The first transcontinental train trip.
On May 23, eight of the most elegant train cars America had ever seen steamed out of Boston for the Pacific Coast, with 129 distinguished guests aboard.

And when they gathered to celebrate in the mahogany-paneled smoker, what other Kentucky whisky would have been more appropriate than Early Times?

Today, its smoothness is just as prized. Because we're still slow-distilling it the same way we did in 1860. So you don't have to look back to the good old days. You can look forward to its great taste tonight.



1860

TODAY

PHOTO HINTS

Portable safelight



Make a portable safelight for your darkroom by clamping a safelight lamphead to a flexible gooseneck. Gooseneck with metal base works best.—Ken Patterson

Save batteries



Slip a piece of card stock between the battery tops and the battery compartment cover of your flash unit to prevent accidental discharge of batteries. The protruding end of the card will remind you to remove it before taking a picture.—Frank H. Day

Prolong developer life



As developer solution is used up, oxygen in the container causes rapid deterioration. But, if you exhale into the container and quickly replace the cap, carbon dioxide in your breath will preserve solution.—Robert C. Barnes

Valvoline 1-2-99 Brings Out the Man in You.



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"...there's no better way to go motoring and pedaling too."

Auto Editor, Popular Mechanics

The Auto Editor of *Popular Mechanics Magazine* evaluated the BikeBug as an alternative to mopeds ... and his choice was the BikeBug! His two-page Product Report, (Dec. '77), was based solely on quality, design and performance. Price was never a consideration, even though mopeds cost hundreds of dollars more (Complete reprints with our free brochures).

The BikeBug engine and front-wheel-drive unit bolts in minutes to the front fork of any bike, from 10-speeders to adult tricycles. It runs up to 24 mph, gets 215 mpg, operates quietly, starts automatically, has a One-Year Warranty, and allows normal pedaling, even with the engine running.

For superior all-round performance, regardless of price, it's the BikeBug. And *Popular Mechanics* agrees.



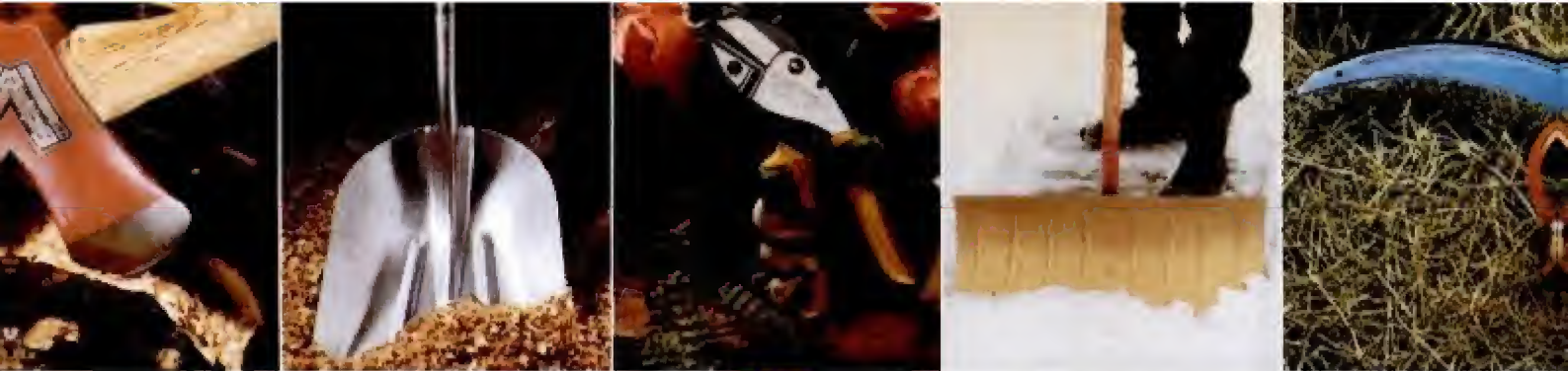
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resists rust.

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with minimum damage to grass
or growth.

Tine spacing designed
to reduce leaf clogs.

Tempered steel teeth
give maximum
strength,
spring action.

Straight-edge
rakes close to
walls, borders.

SL22 LAWN RAKE

TRUE TEMPER

PM WORKBENCH

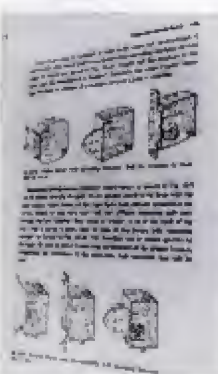
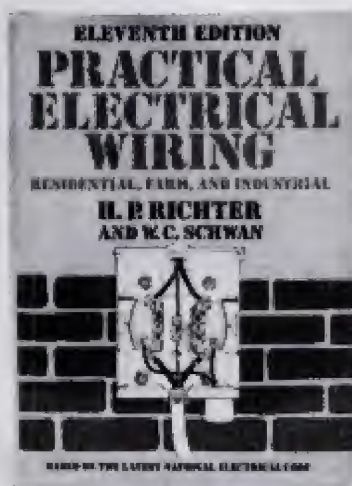
PM EXAMINES PRODUCTS AND SERVICES

Your home as an investment

At a 10 percent annual increase in value, the owner of a \$50,000 home is realizing about \$5000 or more appreciation annually. According to the National Assn. of Realtors, home values are rising by 11 to 13 percent annually. For many first-time home buyers, the monthly mortgage payments may seem steep, but remember the amount stays the same throughout the life of the mortgage. At income tax time, a homeowner can deduct real estate taxes and interest paid on a mortgage, too. For many homeowners, that can add up to several hundred dollars a year.—H.W.

Excellent wiring book

Because it is laid out as an instructional manual, without presupposing any prior knowledge by the reader,



Revised and updated, 11th edition of Richter's book provides latest information on advances in grounding, wires, cables and other useful materials.

er, *Practical Electrical Wiring: Residential, Farm and Industrial* is excellent for do-it-yourselfers. The book by Herbert Richter and W. Creighton Schwan is at most bookstores. It sells for \$8, from McGraw-Hill.—H.W.

Tiny tools are big aid

Mini-Tool Set No. 11-0119 is ideal for those tough chores when you work with small parts, such as repairing eyeglasses, cameras, sewing machines. Priced at \$7.50, it's sold at hobby, hardware and photography shops. The set consists of a handle



Toolkit comes in a handy plastic carrier. Author keeps his stashed in a photo gadget bag for on-the-spot tightening.



and 10 tools, including awl, Phillips and Allen shanks and slotted screwdrivers. If you can't find it locally, write Moody Tools Inc., 42-60 Crompton Ave., East Greenwich, R.I. 02818, for buying information.—H.W.

In-door intruder protection

Called Super Viewer, this in-the-door viewer will help protect against intruders because the 180° wide angle lets a person inside see out in all

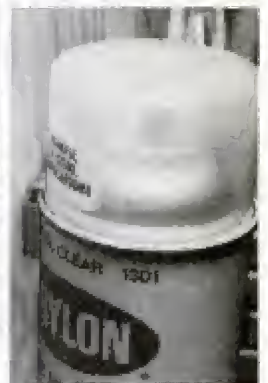


Wide-angle viewer is designed for use in 1 3/4 to 2 1/4-in.-thick doors.

directions—even spot someone hiding at the side of the door. Solid brass with a three-element lens and easy to install, it's \$4.50 at home centers, hardware stores. The Butter Co., 14800 West Commerce Drive, Menomonee Falls, Wis. 53051.—H.W.

Low-cost shop organizer

Every once in a while something comes along that triggers the why-didn't-I-think-of-it kind of reaction. That's the way I felt when I opened the first package of Handy Hangers. The metal clips are shaped to hold several types of cans, particularly



Hangers hold various sizes of cans (top); each fastens to wall with a screw (above). Hanger hooks onto can's rim (right).

those used most often in the workshop—spray paint and coffee cans. Each holder goes up with a single screw. Now, previously unused high-up wall space holds a dozen miscellaneous cans. A set of four hangers costs 98 cents postpaid. Hangers are also available at bulk rates for commercial shops. B & J Vinyl Repair, Box 738, Richardson, Tex. 75080.—H.W.

If you've come across a new product with some special features let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.



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Remember your first set of wheels

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HINTS FROM READERS

Handy bench vise



Make this handy bench vise of 3/4-in. scrap wood and three 6d box nails. Straight piece is a stop. Other piece is attached with one nail, which acts as a pivot. Fasten the pivoting member as needed, in relation to the fixed piece, to fit workpieces.—*Fred Hails*

Cutting plastic foam



A hobby-knife blade attached to tip of a soldering gun neatly cuts plastic foam.—*Ken Patterson*

Smoothing rough wood



You can smooth the rough surfaces of end grain and plywood edges. Apply epoxy glue to the surface, lay plastic film over it, and squeeze the surplus glue out with a screwdriver shank. When glue has hardened somewhat, peel off the plastic and trim any overflow. If needed, file or sand wood.—*Walter E. Burton*



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'79 DATSUN KING CAB® Meet a half ton of tough! Like big rigs, the King Cab boasts a ladder-type frame and all-steel bed that helps it haul a bigger payload than some larger pickups.

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MPG HIGHWAY
*Excludes California where mileage will be lower. Standard 4 speed. Use these numbers for comparison. Actual mpg may differ depending on speed, trip length, and weather. Actual highway mpg will probably be lower than EPA highway estimate.
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**Source: R. L. Polk, Truck Registrations



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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY
MORT SCHULTZ



Post haste

I need help. I own a 1975 Pinto. As you know, Ford has recalled these cars for a gas-tank modification. I never received a letter authorizing a dealership to perform the work, because I am not the car's original owner. What should I do?—Randy Lucas, Bowling Green, Ky.

Take the car to a dealer now—the problem could be serious. As a second owner of a recalled car, you don't get a letter, but you don't need one. Furthermore, the work is to be done free of charge.

This recall applies to all '71 to '75 Pintos and '75 to '76 Mercury Bobcats, except station wagons. The modification calls for installing a polyethylene shield to reinforce the gas tank and for extending the fuel filler pipe to reduce the possibility of gas leakage.

Datsun versus Champion

Can you tell me if the Champion N-10Y4 sparkplug is authorized as a replacement for the original-equipment NGK sparkplug in a 1978 Datsun 200SX? If it is, why does the service manager at the dealership refuse to guarantee a tune-up done with Champion plugs?—Mara Campbell, Mercer Island, Wash.

The Champion N-10Y4 sparkplug is a replacement for the NGK6ES/11 original-equipment plug. Those comments made to you by your service manager were echoed by other Datsun service managers I spoke with. They discourage customers from using Champion as well as any plugs other than NGK because, they say, "aftermarket plugs begin to break down between 3000 and 6000 miles, making cars buck and miss."

Jim Boordman, technical director for Champion, alluding to the "original equipment syndrome," states his department's investigation of plugs taken from Datsuns reveals that vehicle problems are not being caused by sparkplugs. He says plugs aren't being gapped properly in some cases.

Correct gap for Champion plugs put in your 200SX is .044 inch. "In other cases, a problem inside the engine is causing deposits to form on plugs, shorting them out," Boordman says.

Boordman states Champion will gladly check Champion plugs taken from Datsuns if problems afflicting engines are diagnosed as sparkplug-induced. Send plugs to Customer Service Dept., Champion, Box 910, Toledo, Ohio 43661.

From one nut to another

Regarding the problem Bruno Mayer is having with his rebuilt '74 Pontiac 350-cu.-in. V8 engine (Got to Be This or That, March, '79, Car Clinic, page 73), your analysis of rocker arm trouble is right on. But let me add something. We have experience in our shop with two in-shop and one factory rebuilt. The Pontiac torque specification for rocker-arm nuts is just no good.

Torquing nuts to the called-for 25 ft.-lb. causes lifters to bottom and valves to open. Using less of a torque is not a cure, because nuts then vibrate loose.

The solution is to replace Pontiac's

nuts with self-locking nuts used in Chevrolet's 350-cu.-in. engine and adjusting nuts according to Chevy's procedure. This method, relayed to us by a local Pontiac service facility, has worked in every case.—Bill Lee (no address given)

Right on, yourself, Bill. Rocker-arm nuts (part No. 3744341) for the '74 Chevy 350 are different from rocker-arm nuts (part No. 538343) for Pontiac's '74 350. The Chevy adjustment procedure, as follows, is far different from Pontiac's of simply tightening nuts to 25 ft.-lb.:

Tighten nuts to remove pushrod-to-rocker arm clearance. Determine if clearance has been eliminated by rotating pushrods by hand as you tighten nuts. When pushrods can't be moved in relation to rocker arms, clearance has been eliminated. Now, just tighten the nuts with one additional turn.

Change your brand

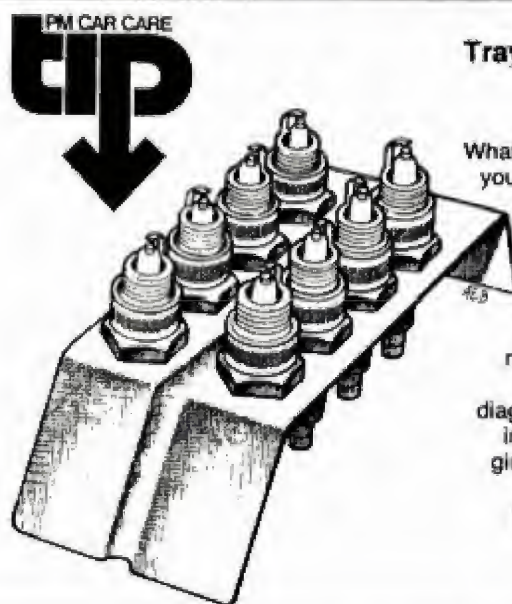
With the windows of our 1978 Chevrolet Impala closed, fumes inside the car from the catalytic converter are very strong. The exhaust system has been checked for leaks, and with this the dealer has given up.

Is it possible for the converter to have a leak on its top surface? How can this be checked? What else is there to consider?—Ronald Schreiber, Staten Island, N.Y.

It's possible for the converter to have a top-side leak. The way to find out is to drop the converter and look. However, it's more likely that the engine is running too rich or that your brand of gasoline contains a high concentration of sulfur, causing an excess of hydrogen sulfide.

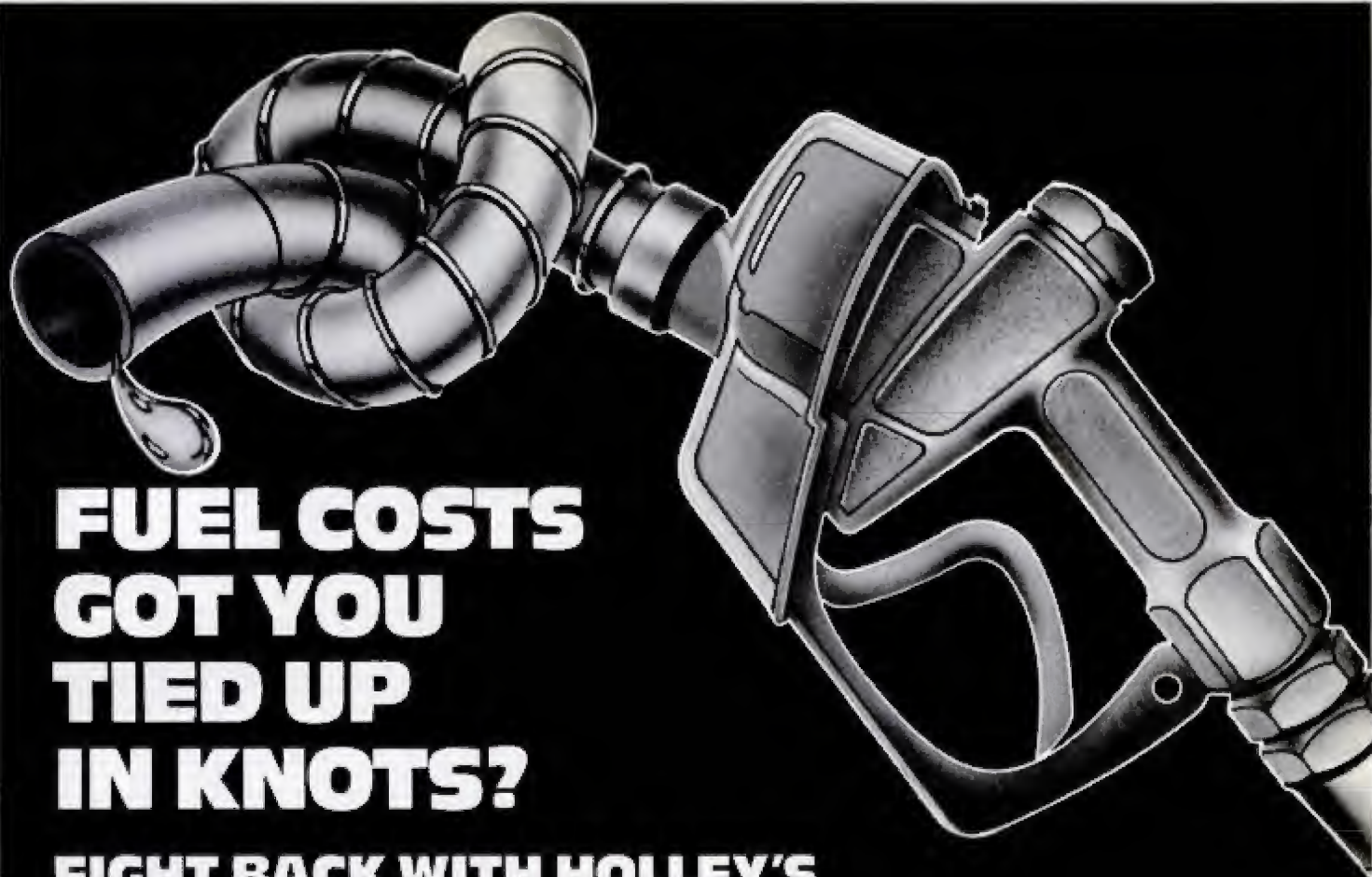
Change your brand of gas. If this doesn't clear up the condition, check engine curb-idle speed, idle fuel/air

(Please turn to page 42)



Tray bon

What's the least expensive engine analyzer at your disposal? Would you believe old sparkplugs! A close examination of those plugs as you pull them from the engine can tip you off to the existence of a variety of problems. For example, finding a single overheated plug tells you that the intake manifold near the cylinder from which the plug was taken may be leaking. But to accurately diagnose a problem, you have to keep plugs in order as you remove them from the engine. This is where a sparkplug tray comes in handy. You can either buy one (illustration, left) or make one by drilling holes (4, 6 or 8) that are large enough to hold plugs in a piece of 2x4.



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Holley ECONOMASTER carburetors are available at leading auto parts dealers and at NAPA stores as Holley "FUEL SAVERS." Actual fuel economy may vary, due to application and driving conditions.

CAR CLINIC

(Continued from page 40)

ratio and ignition timing settings. See that the air pump is operating and that vacuum hoses are routed correctly.

Also keep in mind that odor given off by other cars can enter your car when the heater or airconditioning is operating and windows are closed. Make sure body openings are sealed. The dealer can pinpoint leaks by using an ultrasonic leak detector.

SOS for RS

In the March '79 Car Clinic (Cranky Dipstick, page 73), you reported a problem Ray Sorg was having regarding the proper amount of oil in the crankcase of his '73 AMC Hornet. He claims the manual says it holds five quarts of oil.

Actually, the manual states that it needs four quarts in the crankcase and one quart in the filter. Therefore, after an oil and filter change, he should put in four quarts, mark the dipstick at this level and add one quart for the filter. Your answer would cause overfilling and foaming of oil.—George Musculus, Manistee, Mich.

Your letter was one of a number I

received about this goof, George. You and the others are right, of course. Thanks for bringing me up short. Ray Sorg—are you paying attention?

Fannin' the fires

We are having a problem with carburetors of Chrysler cars equipped with 318-cu.-in. engines. The problem involves acceleration lags. We have put dashpots on the carburetors, but this hasn't helped. Can you tell us what else to do?—(Bill) Fannin Service Center, Milton, Ind.

I'll try, Bill. I guess you have played with the float setting, but are you aware that this specification varies from carburetor to carburetor and may not be the specification in the service manual? The two dominating settings are $\frac{1}{4}$ inch, $\pm\frac{1}{32}$ inch, and $\frac{3}{16}$ inch, $\pm\frac{1}{32}$ inch. If one doesn't solve your acceleration problem, try the other.

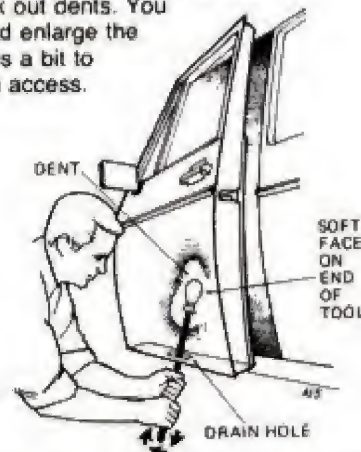
A number of service bulletins have been issued that cover modifications of carburetors used on the 318-cu.-in. engine. Two significant ones are:

■ For '77 models with automatic transmission—installing a repair kit to improve surge and acceleration sag. Kit No. 4049182 applies to

Another use for drain holes



Removing door panels is no fun—it's a lot of work and you're lucky if everything fits back together well enough to look as good as new when you're done. The next time you get a dent in your door sheet metal, consider this approach before removing the door panel. In some cars you can get to that dent by inserting a pry bar through drain holes in the bottom of the door. From underneath, you may be able to work out dents. You could enlarge the holes a bit to gain access.



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©The Gillette Company, 1979



Available in pump or aerosol.

Volare and Aspen; kit No. 4049186 applies to other cars having the 318 engine.

■ For '75, '76 and '77 vehicles which have the Carter two-barrel carburetor—the installation of a new accelerator pump cup kit (part No. 4094866).

To get all service bulletins that apply to this problem, write Chrysler Corp. (CIMS No. 416-02-37), Service and Parts Sales Div., Customer Relations, Box 40, Detroit, Mich. 48288. The company has bulletins for '75, '76 and '77 models available in booklet form. Similar service bulletins for '78 models will be along later in the year.

Clutch chokes in the clutch

I have had to replace the clutch of my 1975 Oldsmobile Starfire three times in 18,000 miles. I drive in city traffic, so the transmission is usually in second gear and seldom higher than third.

The clutch is adjusted periodically for 1-inch play. Do you have any suggestions? —Robert A. Wiacek, Chicago, Ill.

A clutch is one of the most reliable parts of a car and gives over 50,000 miles service unless something goes wrong. What can go wrong? Only

certain, specific things that you can often avoid:

■ Riding the clutch. This kills more clutches than any other cause. Even resting your foot on the pedal may cause wear. Remember to keep your foot off that pedal except when shifting.

■ Not pressing the clutch pedal all the way down to the floor when you are shifting.

■ Improper adjustment. This doesn't seem to be a problem in your case.

■ Flywheel housing is misaligned or the flywheel itself could be warped.

■ Grease or oil is getting on the clutch plate.

■ Defective clutch, but after having three of them, you should have hit on one good one at least for the money you must have paid.

■ Your motor mounts have worked loose.

You take it from here.

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

SERVICE AND SAFETY TIPS

■ The American Automobile Assn. reports that towing a 1979 Datsun 280ZX in the conventional manner can damage the front body panel or rear-brake hydraulic lines. AAA also advises extreme caution when towing other imported cars having front-wheel drive and automatic transmission. They should be pulled on all four wheels, for short distances, or placed on a dolly. Check your owner's manual for instructions.

■ The recent move to higher-inflation tires, including temporary spares that require pressure of 60 p.s.i., had prompted development of a new tire-pressure gauge calibrated to 80 p.s.i. Most older gauges go only to 50 p.s.i. If your tire dealer doesn't have the new gauge, send a check or money order for \$1.75 to Gauge, Tire Industry Safety Council, Box 1801, Washington, D.C. 20013.

■ Subaru is recalling all 1977 and 1978 models to install a carburetor shield and to improve crankcase ventilation. Tests have revealed that in cold weather, carburetor icing and throttle-valve sticking may occur, leading to loss of power and to stalling. If you are the first owner, wait for a recall notice letter to contact your dealer. If you are a second owner, call a dealer and make an appointment. Repairs are free.

■ Chrysler has announced the release of a new cylinder-head valve-cover gasket to stop oil leaks in 1978 and prior-model cars and trucks with 400- and 440-cu.-in. engines. The new gasket, made of silicone, is part No. 4027092.

PM

ALL OUTDOORS

Better bull's-eyes

The sharpest shooter in the country right now is probably Lt. Col. William McMillan, U.S.M.C. retired. He may also be the best in the world. If he qualifies next year, as expected, for the Moscow Olympics, it will be the seventh time he has been a contender—20 years since his gold medal and the first time any athlete has taken part in that many Olympic Games.

How can shooters train to beat him? We asked him recently during



Lt. Col. McMillan holds first stainless S&W .44 magnum, auctioned for \$80,000.

an exclusive interview. It's more than practice, he admitted. Rapid fire, his specialty, takes more muscle and nerve control than perhaps any other sport. It also develops the emotional maturity, assurance and self control that makes the sport safe and satisfying.

Find a good coach who can start you with proper technique and safety habits, advises Bill. An air gun and an indoor range at home can provide excellent practice. The challenge of competition against other shooters is important training, and range work three times a week makes a good program. For McMillan, however, there is much more. Two months before a major event he

augments his regular exercise workouts with a schedule that includes six hours of sleep at the same time every night, no cigarets, liquor or coffee, and special muscle relaxing to relieve tension a half hour before he must step up to score perfect center hits on five targets in three seconds. Rapid fire requires a combination of coordination, instinct shooting and judgment that McMillan is now teaching as instructor to the San Diego (Calif.) Sheriff's Department.

The United States is one of the few countries that does not finance Olympic athletes. Instead, individual donations should be sent to the U.S. Olympic Committee, 57 Park Ave., New York, N.Y. 10016. Recently, Smith & Wesson auctioned off their first new stainless steel .44 magnum revolver and turned over the resulting \$80,000 to the Olympic Committee.

With an air rifle, you can also qualify for the Presidential Sports Award. A total of no more than 50 shots a day must be fired in 50 sessions on a 10-meter range over a period of four months. The Air Rifle Shooters Personal Log Book in which scores must be recorded is now packed with every new Daisy Power Line air rifle, or can be ordered from Daisy at Box 220, Rogers, Ark. 72756, or the Presidential Sports Award, Box 1412, Annex Station, Providence, R.I. 02904. A qualifying shooter who completes the log sends it with \$3 to the Providence office to receive a shoulder emblem, pin, and Presidential Sports Award Certificate.

Action afloat

Those magnificent thunderboats, the Unlimitecs, will be hosing out roostertails at Detroit and then Madison, Ind., for the Gold Cup, followed by events in El Dorado/Wichita, Kans., and Tri-Cities, Wash., this month. For a more quiet weekend, Mystic Seaport in Mystic, Conn., will host a rendezvous July 27 through 29 for antique and classic power and sail boats which were built before 1940.

Underwater safety has recently been surveyed by the National Oceanic and Atmospheric Administration (NOAA), with the conclusion that rate of accidents among the 2.5 million scuba divers in the country is small but should be improved. Statistics show over 100 fatalities a

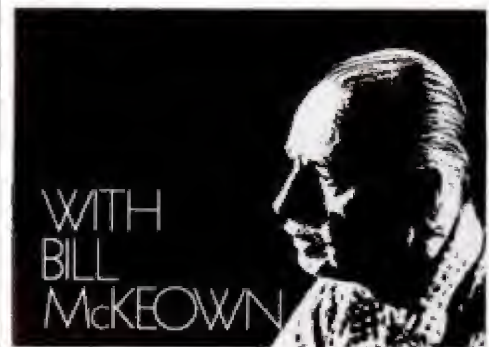
year, with Florida first and California second among states in which such deaths occur. Cave diving appears most dangerous. And many other fatalities are caused by taking chances or ignoring proper procedures. Equipment failure, however, was in no case the primary cause of a fatality.

Weather watch

A forecast and storm warning system first developed for boats and aircraft has now been expanded by NOAA so that over 250 transmitters are in use across the country and 345 are expected to be in service by the end of the year. Broadcasting on VHF 162.4, 162.475 or 162.550 MHz, the messages are repeated continually 24 hours a day with updating every few hours. Individual ranges of the stations vary up to 40 miles, and small pocket receivers are available from \$10 up. More expensive models (about \$35 or more) can remain on standby and give out an alarm if triggered by the station when severe weather threatens. And for \$90 from Edmund Scientific, 7782 Edscorp Bldg., Barrington, N.J. 08007, a Storm Scan Alarm can be ordered that is activated by the electricity of severe storm. It can sound an alert in advance of a bad thunderstorm or tornado without receiving any broadcast signal. The small Storm Scan box weighs only three pounds and is powered by a replaceable six-volt battery.

RV aids

Accessories and replacement parts for vans, off-road rigs and recreational vehicles are often not stocked by local auto-part outlets. J.C. Penney, Sears and Montgomery Ward are now carrying more of these items in their stores and listing them in their catalogs. A list of dealers stocking the Good Life Catalog of RV gear is available from C/P Products, Box 965, Elkhart, Ind. 46515.





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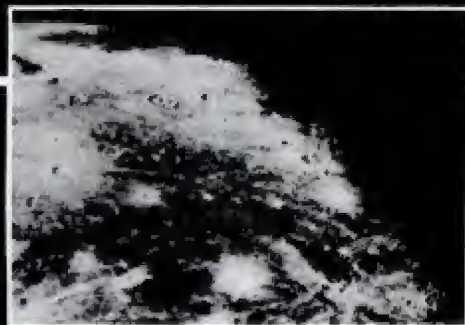
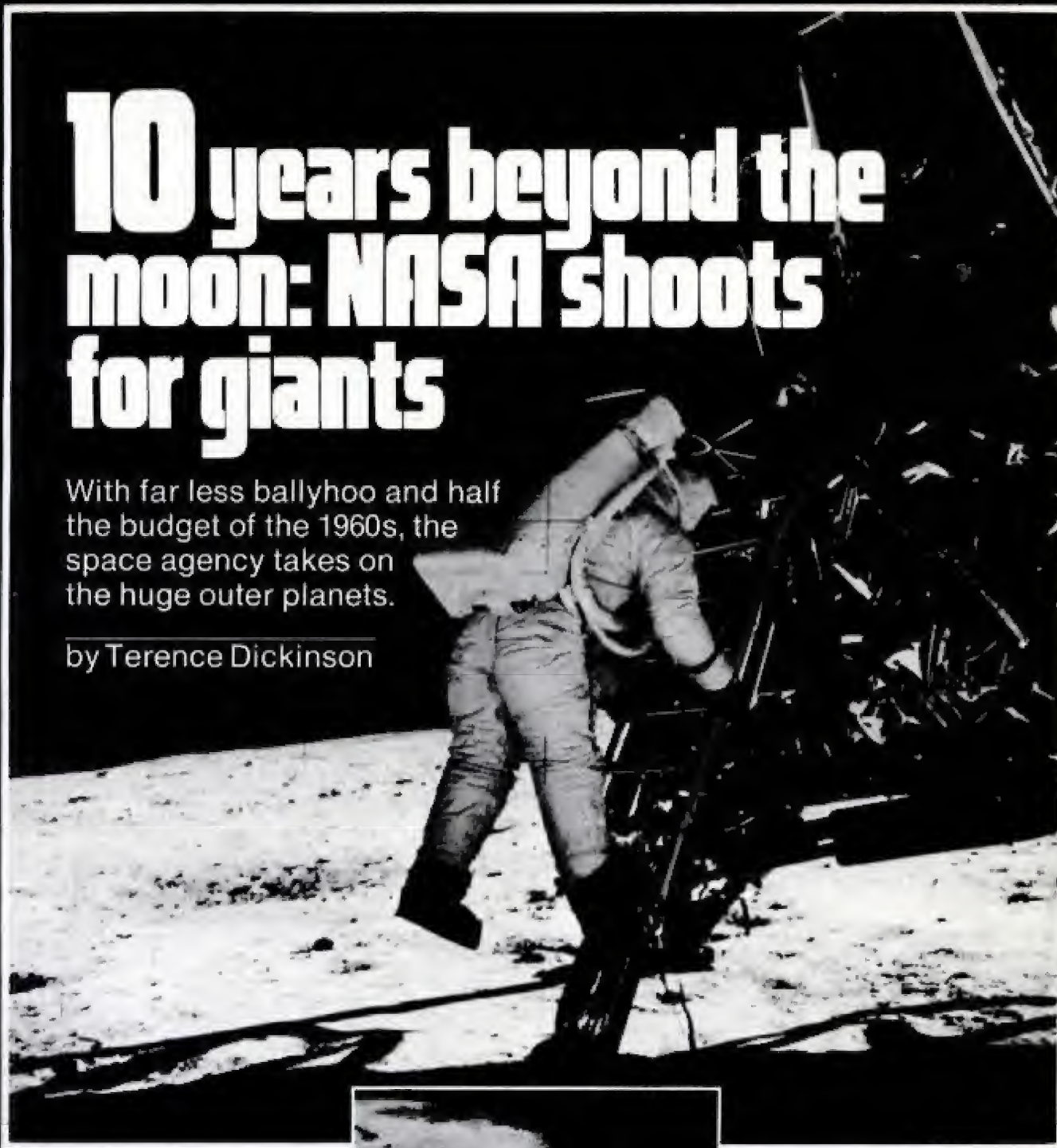
Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

Kings: 17mg "tar," 1.0mg nicotine
100's: 18 mg "tar," 1.1 mg nicotine av. per cigarette, FTC Report May '78

10 years beyond the moon: NASA shoots for giants

With far less ballyhoo and half the budget of the 1960s, the space agency takes on the huge outer planets.

by Terence Dickinson



Astronaut Edwin E. Aldrin Jr. takes the final steps onto the moon in 1969 photo by Neil Armstrong. Lower photo, taken by robot craft, shows Jovian moon Ganymede.

Ten years ago this month mankind's exploration beyond Earth reached its zenith when two humans set foot on the airless plains of our nearest celestial neighbor, the moon. The Apollo moon flights were the crowning achievement of a decade of intensive space hardware development spawned in the paranoia of a cold war.

That era, when men's voices crackled back to Houston from the lunar surface, has ended. Actually, it was declining before the first manned Apollo soared away: Even then scientists were looking hundreds of millions of miles beyond the moon toward the planets. At such distances, they knew, the country could no longer afford the

risk and elegance of life-support systems. Manned missions would become something of an antique. Robot explorations would replace them.

But despite the turn toward cold machinery, despite funding that pro-

vides only half the buying power of NASA budgets during the boom years of the 1960s, the American space program is surprisingly lively today—although the hoopla is gone along with much of the media hype.

Walter Cronkite wasn't there, for instance, when rings around Jupiter were discovered in a hazy, black-and-white picture transmitted from the Voyager 1 spacecraft to California's Jet Propulsion Laboratory last March. A technician snapped a Polaroid of the TV screen showing an odd collection of squiggly lines from the huge planet almost half a billion miles away. The crude snapshot passed from hand to hand, puzzling some scientists, in-

triguing others. Then astronomer Tobias Owen of New York carried it into the littered office of Bradford Smith, leader of JPL's imaging science team. Owen pushed aside some of the dozens of Voyager photos on Smith's desk and dropped the evidence of the rings.

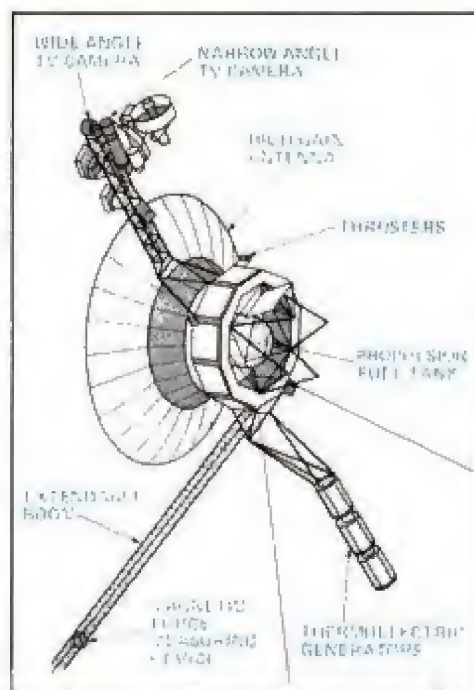
Smith stared. Then he stood up and smiled. No one will ever cut what he said into stone. "Is this what I think it is?" he asked.

"Yeah, it probably is," Owen answered. There was no talk of Eagles landing or giant leaps for mankind—just simple recognition of extraordinary news.

NASA scientists knew in 1969 that the lunar mission, named Apollo after the god of manly youth, would be a hard act to follow. On launch day, July 16, 1969, show business celebrities packed bleacher seats with Vice President Spiro Agnew. They watched as cascades of orange flame began to gush out of the rocket. The sound of thunder rolled over the stands 15 seconds later—the launch pad was three miles away—but many in the crowd had tears in their eyes even before they heard the rumbling. There were three men in there, packed into a capsule, soaring up to put our mark on the moon. It didn't seem likely, in those days of plunging budgets, that the 1970s could come up with anything to equal the drama.

Probes toward the giants

But the Voyager missions alone—Voyager 2 is due to pass Jupiter this



Voyagers 1 and 2 carry plutonium-powered generators to send TV photos from space.

month—have proved skeptics wrong. With comparatively little fanfare, NASA today has become David against Goliath, flinging probes toward the giant outer planets of our solar system—Jupiter, Saturn and possibly Uranus and Neptune.

Arrival times for the robots are staggered, so that while scientists are still poring over data from one robotic probe, another begins beaming surprises to Earth to compete for attention. Pioneer 11 will arrive at Saturn this fall. The two Voyag-

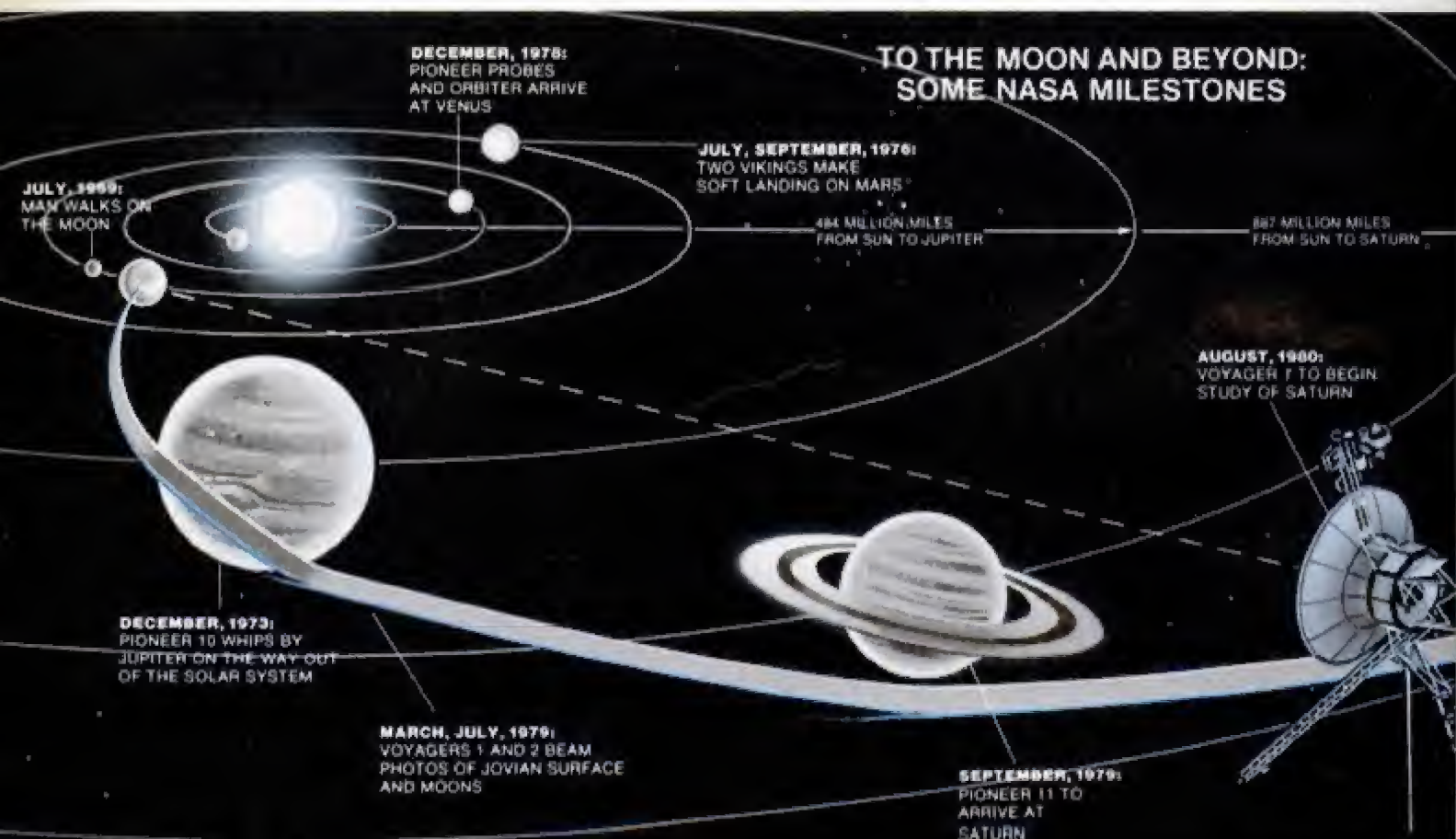
ers will encounter Saturn in 1980 and 1981, respectively. NASA plans to launch another Jupiter mission, Galileo, early in 1982; when it arrives in 1985, it will fire a probe toward the planet to pulse back data to a mother ship before Jupiter's murky, dense atmosphere crushes it. Voyager 2 may rendezvous with Uranus in 1986, and Neptune in 1989. Compared with Apollo explorations, each of these probes is a bargain. The Voyagers roaming from planet to planet, for example, cost about one-fiftieth as much as the Apollo program, or \$500 million, as compared with \$30 billion for moon exploration. But information received from the Voyager missions has already proved spectacular, its drama rivaling—and sometimes paralleling in weird ways—the mythology which gave the planets their names.

Like paintings of hell

Besides finding Jovian rings, Voyager 1 flashed back photos of moons that make our own seem pale, and of a planetary surface that looks like classical paintings of hell.

"This isn't science, it's art," said one observer, as pictures appeared in California line by line, the perspective changing every minute or so. The photos of the Jovian surface showed whorls and stripes, the outlandish face of clouds—specks of frozen ammonia and other ice crystals—whipped into odd shapes by Jupiter's speedy rotation.

The clouds cover a planet with a





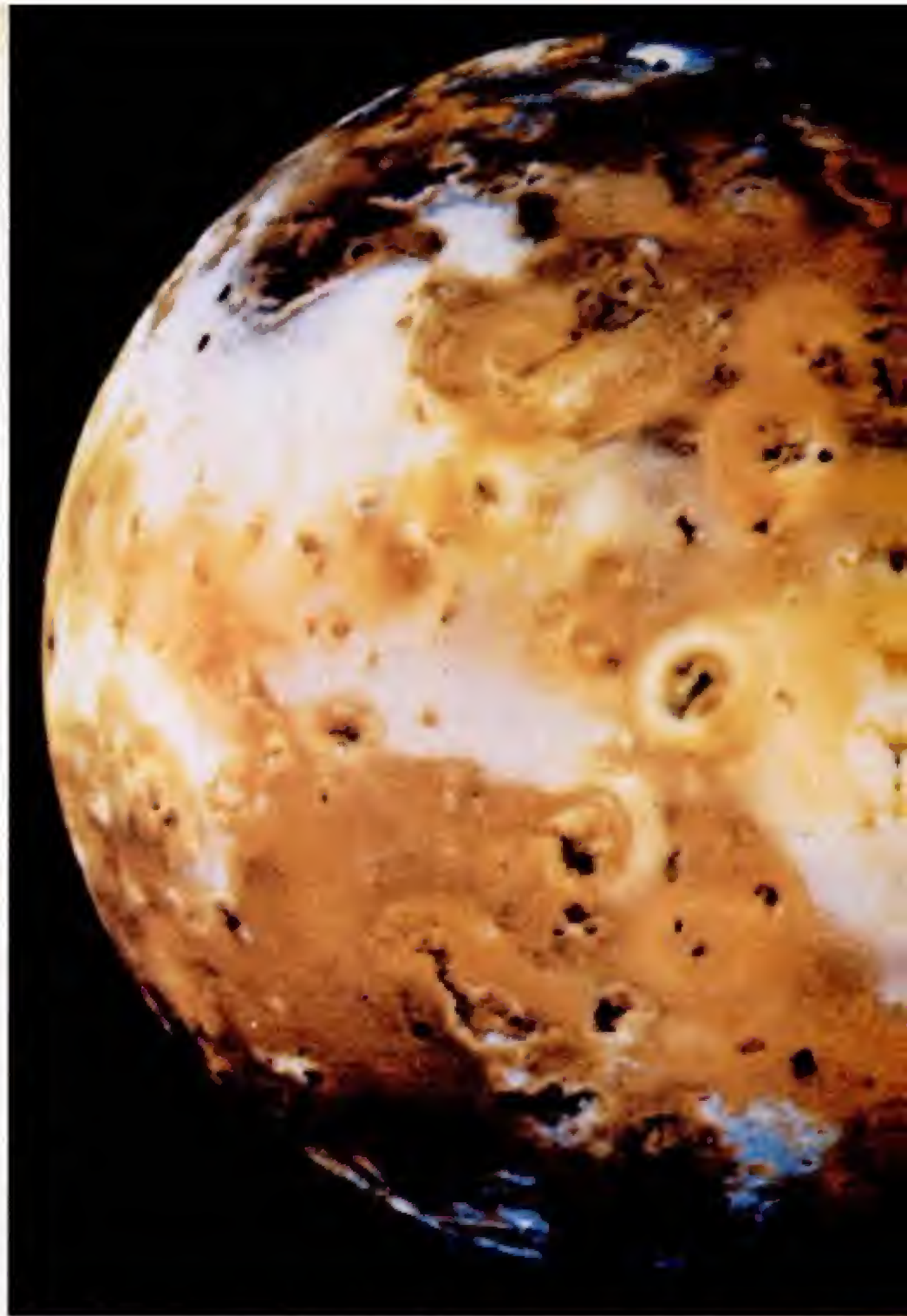
As Voyager 1 closes in on Jupiter . . .



. . . moons Io (left, above Red Spot) and Europa begin to show surface features.



Computer enhanced this Red Spot photo.



Volcanic activity on Io, seen at 500,000 miles (above) and 226,000 miles (below), appears so intense that some think this moon is slowly turning itself inside out.



Planetary probes since the 1969 Apollo moon landing have explored the hellish atmosphere of Venus, the rock-strewn surface of Mars, the planet-sized moons of Jupiter, including colorful Io. Coming up: closeup views of Saturn's familiar rings and its moon, Titan.

Leftover LMs and other museum modules

The Apollo program may have ended, but many of its vehicles endure in good shape, never driven by so much as a little old lady.

But don't plan on buying surplus moon-shot gear, or kicking the tires of a moon rover. By law, once NASA no

longer has a specific use for a piece of equipment, it becomes the property of the Smithsonian Institution in Washington, D.C. The Smithsonian, in turn, either displays the space gear in its Air and Space Museum, or loans it to other exhibitors.

The stuff will never fly, not even if you could come up with the \$70 million to pump fuel into a leftover Saturn V rocket. The reason is the owner isn't selling. "The Smithsonian," the institution's registrar told us, like a man with an attic full of trophies, "has never sold anything."

Still, you can see many of the space antiques-in-the-making—enough gear to make three complete Apollo spacecraft. The three remaining unfired Saturns, for example, are on display at the Alabama Space and Rocket Center in Huntsville, the Johnson Space Center in Houston and the Kennedy Space Center in Florida.

The \$185-million Saturn is one of the most elephantine of white elephants. In its time, it could generate the 7½ million pounds of thrust necessary to lift the 6-million-pound Saturn/Apollo package off the pad. Today, incidentally, the huge leftover Saturns are without a pad: The original launching sites at Kennedy have been modified for smaller craft.

You can also see the glamor components of the Apollo program, the little lunar modules, or LMs. The spidery craft carried two of the three-man crew to the surface of the moon, while the third astronaut circled the satellite in the command and service module.

LMs on display

There are four unused LMs left, all manufactured by Grumman Aerospace Corp. One is at the Smithsonian, another at the Visitors Information Center at Kennedy Space Center. Grumman is finishing a third—at no expense to the taxpayer—and hopes to have it ready for public viewing this summer at the Cradle of Aviation Museum on Long Island. A fourth is on display at the Franklin Institute in Philadelphia.

Most of the LMs that were used, incidentally, are still on the moon—but not in very good shape. Each LM comprised a descent stage for landing and an as-

cent stage for taking off. The descent stages remain on the moon. And once each pair of LM riders completed their rendezvous with their mother ships, they jettisoned the ascent stages and sent them crashing back onto the lunar surface, where the ton-and-a-half components created tiny moonquakes. Scientists studied the quakes in an effort to discover clues about the moon's composition.

Life-saving Aquarius

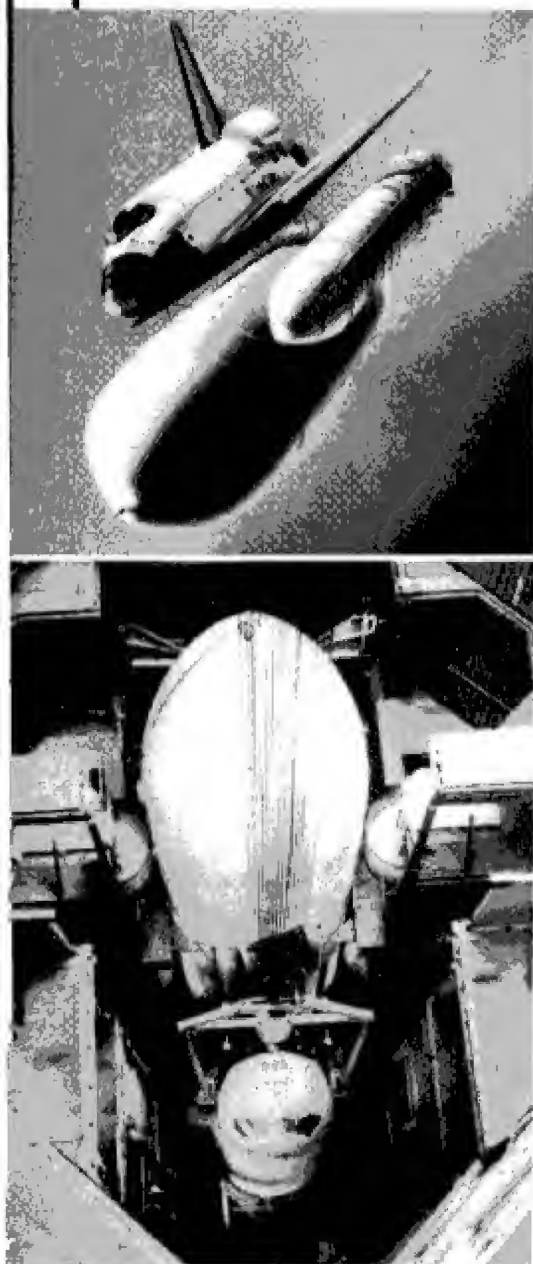
The most famous LM, Aquarius, made it all the way back to Earth, saving the lives of the Apollo 13 crew. Well on the way to the moon, a liquid oxygen tank in the service module blew out, and the crew was forced to crawl into Aquarius to use its electricity and life-support system to get home. Five hours from Earth, the men climbed back into the command module, which had a heat shield for atmospheric re-entry, and cut loose the LM, which did not.

Aquarius almost certainly burned as it hit the air. But our planet probably holds a deadly memento of that fateful mission. On the craft were more than eight pounds of plutonium-238, a highly poisonous radioactive isotope that was to provide power. In a graphite cask, it most likely did not burn up and today sits somewhere on the bottom of the Pacific Ocean—one of the largest supplies of lost plutonium in the world.

Command modules prevalent

By comparison with the LMs, command modules are almost an everyday item in space museums; 11 of them, battered by their fiery re-entries, are on display at museums and exhibits around the United States. And there are three unscarred command and service modules that never flew: one at Johnson, one at Kennedy and one on loan to Japan.

The largest piece of Apollo-related equipment is still getting a workout: The gigantic Vehicle Assembly Building—129 million cu. ft.—is the center of a new flurry of activity at Kennedy. It's being used for servicing and assembling the soon-to-fly Space Shuttle.—*Dick Teresi*



Coming up: Space Shuttle, shown in artist's conception (top) riding launching rockets and in vibration test, will take off from site of Apollo shots at moon.

volume 1300 times as great as ours. Four of its 13 moons are bigger than the planet Mercury. It's a solar system in miniature, with the giant planet playing the role of a sun that didn't quite make it. Had Jupiter been 40 times more massive, its internal pressures would have ignited thermonuclear reactions in its core, creating a small red version of our sun.

The Voyager craft sent to explore this behemoth is impressively large and powerful itself. A backup Voyager (identical to the two now in interplanetary space) on display at the Jet Propulsion Laboratory dwarfs visitors with its 12-foot communication dish, flanked by two 10-foot arms and a longer boom carrying scientific instruments.

Unlike most of its predecessors,

Voyager has no delicate-looking solar cell panels. Beyond Mars, sunlight is too feeble to operate a spacecraft equipped with solar energy collectors. Instead, Voyager carries its own power pack: three radioisotope thermoelectric generators providing about 400 watts for scientific instruments and housekeeping duties.

It took Voyager 1 about a year and

(Please turn to page 100)

New support for space stations?

That's not a space-age Jungle Gym (below), but a model of a structure said to be capable of supporting a one-mile-diameter space station. Inventor-philosopher R. Buckminster Fuller holds what he calls his "tensegrity" sphere—a lattice of rods and cables that is extremely strong and light. None of the rods touch one another, but are held in place by cable tension. Fuller says structure allows repairs in one area without affecting the rest of it.



Paddle-wheel tire

A newly patented, dual-purpose tire resembles a conventional tire, but has lugs projecting from both sides. The lugs don't interfere with highway driving, but help maintain traction in snow or soft ground.



Sweet hitchhiker

To cut fuel consumption, traffic and pollution, a group called Commuter Connection has a \$70,000 government grant to promote hitchhiking. Here, the president of the San Francisco-based group flashes a sign asking for a ride to the city's financial district.



Wing exhales

This A-6 has been modified to incorporate a Circulation Control Wing (CCW) to give better STOL performance. The CCW employs the so-called Coanda effect: Engine



air is blown through a .01-.02-inch slot running near the top rear of the wings. The high-speed air follows the specially rounded curvature of the back of the wing and drags other air along with it, increasing lift. Initial calculations predicted a re-

duction of ground roll on takeoff of 20 percent, on landing of 50 percent, and an approach-speed reduction of 30 percent. Limited tests have confirmed these figures; performance should improve with additional testing.

Owners of the Dodge Omni 024 emerged a little more critical of their cars. They're a younger group, and they tend to do more for themselves—like shift gears and tinker. That's in comparison with owners of the Plymouth Horizon TC3.

Both are three-door hatchback coupes, sporty yet economical—facts reinforced in our survey. Owners by and large have very few harsh words and express more than simple satisfaction in every area but one: rear-seat legroom. That, though, was expected.



Owners praise standard AM/FM radio. Many ordered optional instrument panel.

Most buyers purchased the 024/TC3 for economy, and they haven't driven away disappointed. A Michigan lab technician writes, "I bought an economical car at a good price. My TC3 has helped cut our gasoline bill in half. It gets twice the

PM OWNERS REPORT: TWO-DOOR DODGE OMNI AND PLYMOUTH HORIZON

mileage of our old, big car and three times as much as my four-wheel-drive pickup."

An Illinois foreman says of his Omni 024: "Great gas mileage for my type of driving. It's all in town, sometimes only four blocks twice a day, and I'm still getting over 20 mpg."

Manual-transmission cars averaged about two mpg more than those equipped with Chrysler's TorqueFlite automatic. A few owners remarked that they'd appreciate a five-speed manual overdrive transmission.

It's not that these cars are slouches when it comes to performance, either. Or-

dinarily, gas mileage and getaway power tend to be mutually exclusive, but not this time. "Really good pickup for a small car," comments a Michigan secretary, and a New York student agrees: "Great acceleration with the four-speed transmission."



Adults suffer leg cramps and bumped heads in rear seat, but it's okay for kids.

But what really impresses owners is the coupes' performance in snow and on ice. A Michigan pipefitter proclaims, "We traded a luxury car for this 024 and got the surprise of our lives. Not only is it roomy

BY MICHAEL LAMM WEST COAST EDITOR

Two sporty fwd hatchbacks with very content owners

Outer sheet metal gives no clue to Omni/Horizon parentage.



Different urethane front-end caps distinguish TC3 and 024.

Aerodynamic aid comes from front air dam.

Both cars share 96.7-inch wheelbase—2.5 inches shorter than Omni/Horizon sedans.

and comfortable, with good performance, but the traction and handling during our Michigan winters are unbelievable. We call it a poor man's 4x4. And I know, because I own a Dodge 4x4."

A Georgia power-company employee: "I'm surprised by the front-wheel drive. This is my first fwd car, and its handling capability on wet or icy roads is fantastic."

And a New York systems analyst notes, "Power on demand makes overall performance very good. Excellent handling in town, excellent cruising out on the highway, excellent traction in snow."



Optional electric hatch release gives access to nearly 34 cu. ft. of cargo space.

Owners showed amazing brand loyalty, with very few crossing the Plymouth/Dodge dealer bridge. In other words, among TC3 owners, 37.1 percent also owned Plymouths, but only 8.1 percent owned a Dodge. Similarly, owners of 024s reported possessing additional Dodges (32.4 percent), but only 6.7 percent owned a Plymouth.

Dealer service racked up nearly identical scores from both camps. Dodge dealers got a 58.5-percent mark in the "good to excellent" column, while Plymouth dealers scored 57.9.

The mechanical problem most often mentioned by owners of both TC3s and 024s had to do with carburetors. Rough idle, dieseling, and surging seem commonplace. Carburetor icing in cold weather was reported.

"About two weeks after I got the car," reports a Minnesota waterbed deliverer, "I experienced carburetor problems. The location of the carb exposed it to a draft which, in below-zero cold, caused moisture condensation and subsequent icing. This situation was remedied by the dealer with the installation of two heat shields, one large, one small, strategically placed. However, the problem should never have arisen."

Our respondents waxed rhapsodic about workmanship, grooving doubly over the fact that these are American-

(Please turn to page 136)

A Peek Under The Hood

Beneath those svelte sport-coupe exteriors lurk the underpinnings and mechanical components of the familiar Omni and Horizon sedans. The TC3 and 024 might look like Japanese or European mini-GT cars, but they're built right here in the United States—all but their engines and manual gearboxes.

Powerplants come from Volkswagen in West Germany. These are the same units used in Rabbits, but with slightly longer stroke (13 mm), resulting in 1716 cc instead of the VW's 1457 cc. The Rabbit, however, uses fuel injection, while the 024 and TC3 rely on carburetors. Power output from all these engines is nearly identical—70 bhp. VW also supplies the four-speed manual transmissions, while Chrysler manufactures the automatics.

The 024 and TC3 come only in three-door hatchback body style. With the rear seat folded, there's nearly 34 cu. ft. of cargo capacity in either car. Both coupes are slightly longer overall than their parent Omni/Horizon, but the added length appears in the form of a front overhang.

Standard items include AM/FM radio, rear window defroster, whitewalls, bucket seats, and cigaret lighter. Prominent on the option lists are sunroof, handling suspension, cast sport wheels, more complete instrumentation, power steering and power brakes, and an electric hatch release.

A NATIONWIDE SURVEY BASED ON 729,806 OWNER-DRIVEN MILES

Large glass areas give these cars good visibility.



Hatch has optional electric inside release and key-operated lock next to license plate.

Large doors lack intermediate stop, some owners point out.

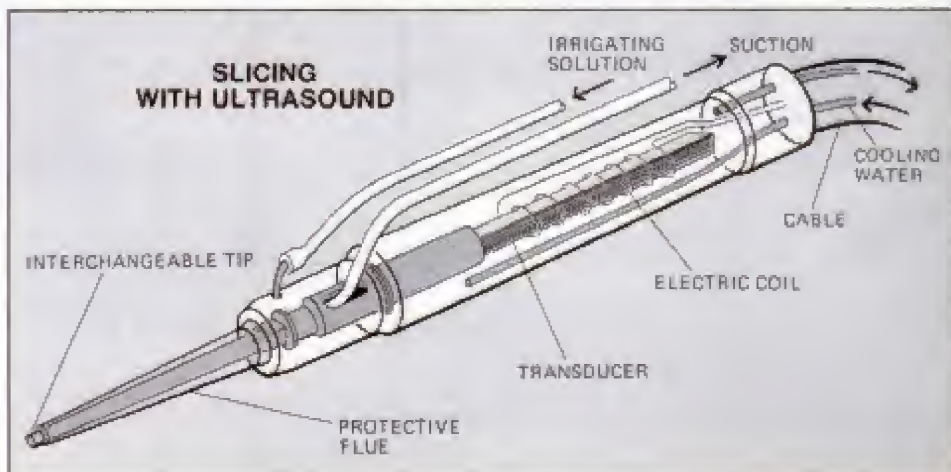
Photos by Robert J. Lamm

Four-wheel independent suspension uses coils all around.



Cavitron ultrasonic surgical aspirator vibrates its interchangeable tip 23,000 times per second. Device is so light and responsive, according to Cavitron, that

doctors using it can distinguish between different layers of membrane inside the brain. Sensitive ultrasonic scalpel is used above in actual surgery.



Ultrasound— new medical marvel

Ultrasonic waves let you watch what's happening inside your body, or they can be used as superprecise scalpels for delicate brain surgery.

by Robert Perry

Remember Bell Telephone's TV documentary, "Hemo, the Magnificent," which ran 20 years ago? We all watched as blood—just like ours—coursed through real veins. Now, science has gone one better. On a TV screen, you and your doctor can watch painlessly as your own body, from blood to vital organs, does its work.

It's done with ultrasonics, medicine's most exciting new diagnostic tool. Doctors are experimenting with sophisticated ultrasonic microsurgical equipment to aspirate (break up and suction off) cancerous tumors and eye cataracts, and to perform delicate brain surgery. And the "painless dentist" is using it, too.

One of these incredible developments, made possible through the marriage of sonar, radar, television and microprocessing, is called "real time imaging" of internal functions of the body.

Real time imaging shows on a TV monitor what is happening *inside* your body at the precise second a doctor does the scan. The scanner transmits high-frequency sound waves, in a range of 2.5 to 10 mega-

hertz (MHz), into the body of a patient. The lower limit of the human hearing range is about 23 kilohertz (kHz). As the sound waves bump into tissue, blood or other fluids, they echo back to the scanner's receiver. Microprocessors in the receiver read the echoes, like microwaves in television reception, and translate them into video signals. The unscrambled echo signal becomes a black-and-white moving picture of the inside of your body.

Ultrasound is rapidly replacing often dangerous X-rays because it "sees" so much more. X-ray negatives can depict only four general densities: fat; calcium or bone; tissue, and gas. X-rays cannot tell whether tissue is soft or hard, or what kind it is. "Sound echoes are sensitive enough to show us what each different tissue looks like," says Dr. Robert Bard of the Manhattan Eye, Ear, Nose and Throat Hospital, a noted author on the use of medical ultrasonics.

Looking behind the eye

This sensitivity has made an enormous difference in hundreds of

(Please turn to page 99)



Ultrasonic photos above provide prenatal baby pictures. Top photo shows head, neck and torso of fetus. Photo below that shows the fetal skull and shoulders.



Scanners like this study heart problems.

This scanner uses a very large transducer, passed over the patient's body, as well as a monitor screen as big as a portable TV.



IT'S NEW NOW

Different boats for different loads



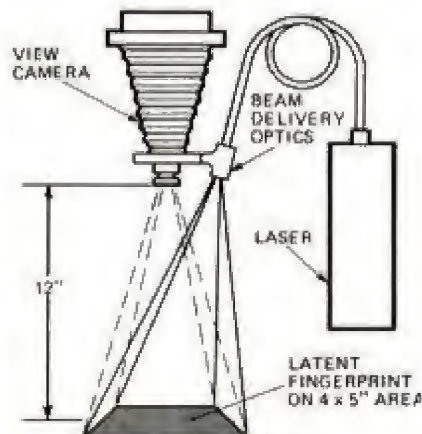
Here are two different ways to achieve a smooth ride during high-speed water travel. The SES 110 (top photo) employs a catamaran-type hull and flexible bow and stern seals that trap a cushion of air to provide lift. Its top speed is about 70 knots. The 110-foot vessel, built by Bell

Aerospace Textron and Halter Marine, is the first American-built, air-cushion-assisted boat made for commercial use.

On a smaller scale, the British River Rover is said to be able to maneuver much better than other hovercraft its size. Special elevon controls (visible in right

photo) give the craft handling characteristics (left) similar to those of conventional boats. With the special controls and inherent hovering capability, the River Rover is said to be able to negotiate difficult rapids both up and downstream. The 20-foot craft speeds to about 35 mph.

Putting the finger on criminals



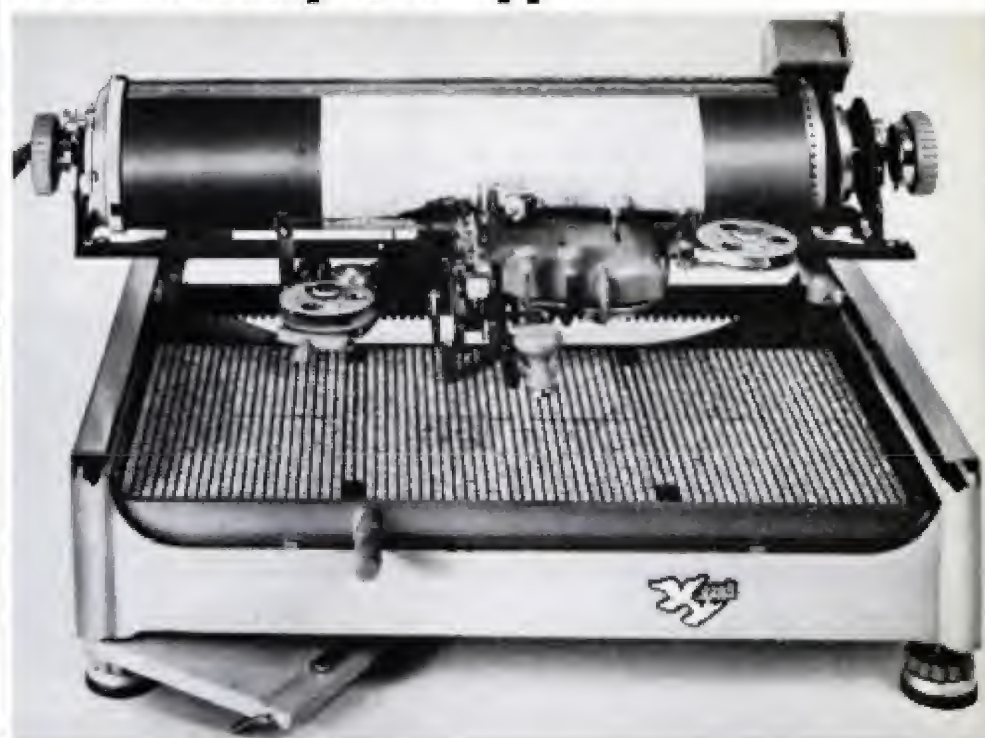
A laser-based fingerprint-detection system is said to be able to find prints on a variety of surfaces, including human skin. The system, developed by Control Laser Corp. of Orlando, Fla., shines laser light onto a 4 by 5-inch area and causes certain compounds in a fingerprint to glow a yellowish color. The image of the print can be photographed with a view camera (see diagram, left) or viewed on a television screen. Prints that escape traditional detection methods can often be recovered with the laser system, the manufacturer says. The method is nondestructive and can scan large objects. It cannot detect prints if a criminal has worn gloves.

Firefighter alarm

Inertia Distress Signal Unit automatically emits an alarm if wearer becomes immobile for more than 30 seconds. Worn by firefighters, the Scottish-made unit summons help in event of injury or asphyxiation. A muted warning is sounded for six seconds; wearer can turn it off if immobility is not a result of personal danger.



Not exactly our type



Increased trade and contact with the People's Republic of China will require increased written communication with that country. What better way to achieve that than with a Double Pigeon typewriter? A product of the People's Republic, it has

one key and 2500 symbols. The mechanism picks up a symbol and types it against the paper. By moving type-filled tray side to side and key front to back, 25 symbols per minute is possible. From the Media Factory in New York City.

Rock slicer

Jaws One isn't much of a menace in the ocean, but on pavement it's a terror. Said to be especially useful for digging trenches where blasting is prohibited, the 70,000-pound machine can cut through almost anything. Each of the 92-inch-diameter cutting wheels has 90 tungsten-

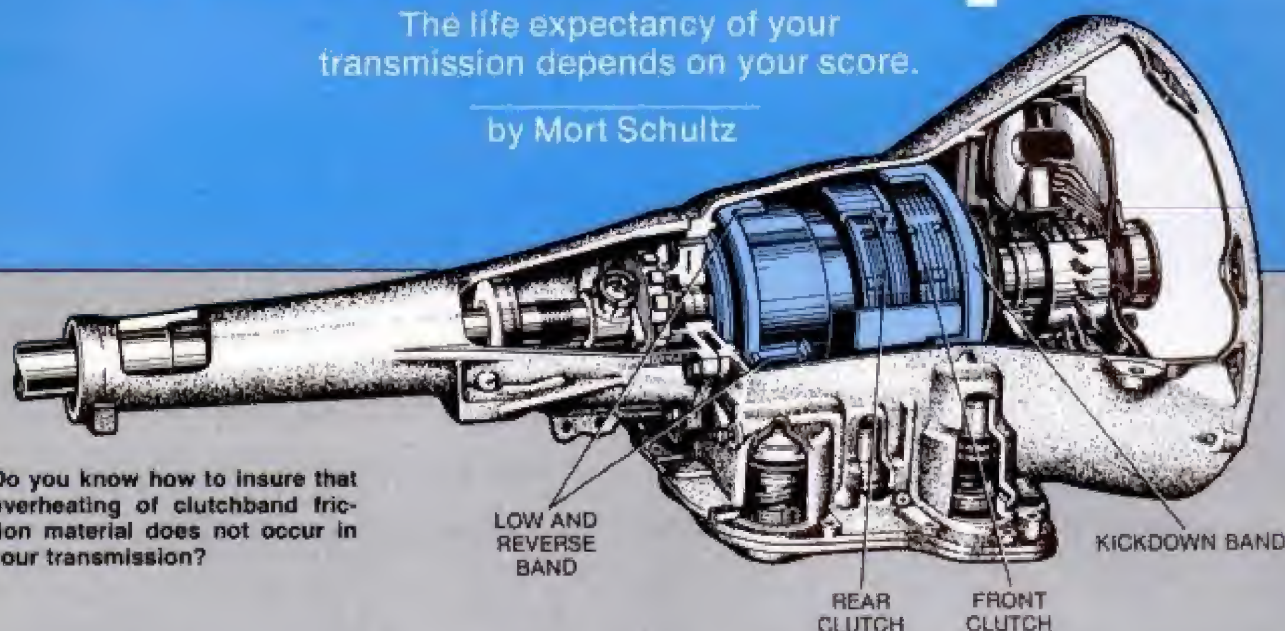
carbide teeth; the cutter has a 36-inch swath. Teeth are first used for side cutting and are then switched to less-demanding center cutting. A backhoe removes the spoil from ditch. Jaws One, from H.B. Zachry Co. of San Antonio, Tex., travels 6 inches to 125 feet per minute while cutting.



Automatic transmission quiz

The life expectancy of your transmission depends on your score.

by Mort Schultz



Do you know how to insure that overheating of clutchband friction material does not occur in your transmission?

The most neglected part of a car is the following:

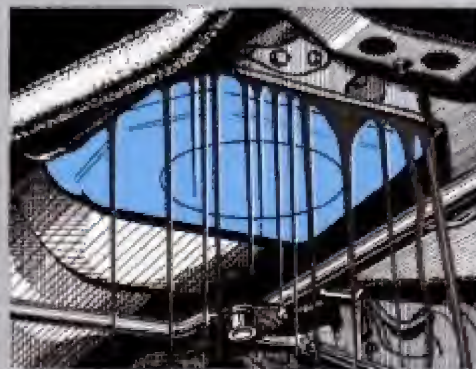
- (a) Battery?
- (b) Drive belts?
- (c) Tires?
- (d) Transmission?

Answer: (d) Transmission. In fact, according to the Car Care Council, transmission tops the "most neglected" list, ahead of such perennials as shock absorbers, front-end alignment, PCV system and spark-plug cables. When a transmission fails, the car owner faces a repair bill amounting to hundreds of dollars.

This quiz tests your knowledge of automatic transmissions. It is intended to help you keep your car out of the repair shop because of transmission failure.

Your score reflects your understanding of important factors in automatic transmission servicing. If you fail to score in the expert range, as outlined on page 144, study the answers.

If your automatic transmission needs an overhaul, you stand a better chance of getting a good job from a mechanic certified by the National Institute for Automotive Service Excellence (NIASE). A national listing of such mechanics can be ob-



Changing fluid in transmissions without drains is messy. How often do you do it?



Do all torque converters have drain plugs like the one shown on this transmission?

tained by sending \$1.95 to NIASE, 1825 K St. N.W., Washington, D.C. 20006.

When you take the following quiz, keep in mind that a question can have more than one correct answer.

Questions

1. An automatic transmission will easily last the life of a vehicle if:

- (a) Bands are adjusted every 30,000 miles.
- (b) Contaminants are purged from the transmission.
- (c) Engine-transmission speed-shift ratio is maintained at specified setting.

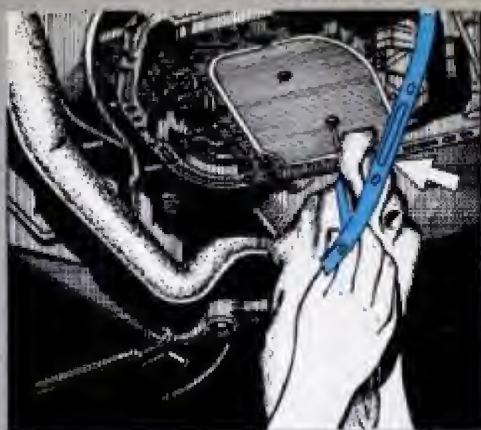
(d) The transmission oil cooler is kept filled.

2. The best way to prevent automatic transmission failure is to:

- (a) Start the engine with the transmission selector in PARK only.
- (b) Accelerate slowly.
- (c) Check transmission fluid level once a week.
- (d) Check the transmission fluid level.

3. Automatic transmission is not shifting smoothly. First thing you do is:

- (a) Check engine idling speed.
- (b) Test engine vacuum.

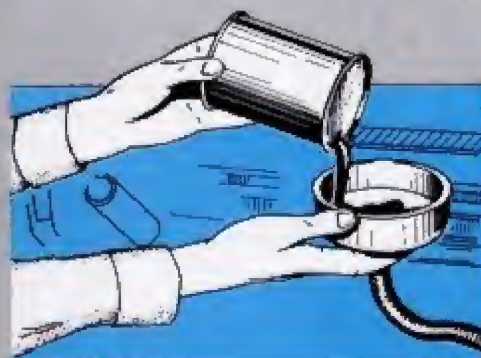


When changing transmission filter, can you reuse the old gasket (see arrow)?

- (c) Adjust throttle linkage.
- (d) Check the transmission fluid level.

4. Fluid on the automatic transmission dipstick looks dark red. This is a sign that:

- (a) A leaking transmission oil cooler is allowing engine coolant to mix with transmission fluid.
- (b) Transmission bands and



Which transmission fluid (of many types on the market) should you use in your car?

- clutches are disintegrating.
- (c) The transmission has been overfilled and fluid has foamed.
- (d) The transmission is performing normally.

5. Fluid on the dipstick looks pink. This is a sign that:

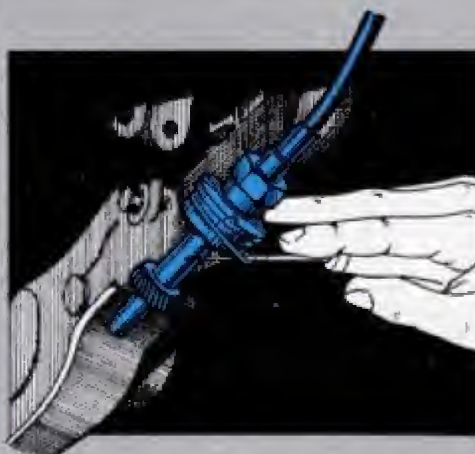
- (a) A leaking transmission oil cooler is allowing engine coolant to mix with transmission fluid.
- (b) Air in the transmission has caused spongy action which has accelerated band and clutch wear.
- (c) The transmission has been overfilled and fluid has foamed.
- (d) The transmission is performing normally.

6. Fluid on the dipstick looks dark brown. This is a sign that:

- (a) A leaking transmission oil cooler is allowing engine coolant to mix with transmission fluid.
- (b) Overheating has taken place, causing disintegration of clutch and



You check level of fluid in your car with fluid hot? cold? Car in which gear?



If speedometer gear, shown here, fails, how does that affect your transmission?

- band friction material.
- (c) The transmission has been overfilled and fluid has foamed.
- (d) The transmission is performing normally.

7. Transmission fluid is low and fresh fluid has to be added. You should use:

- (a) Dexron.
- (b) Dexron II.
- (c) Type F.
- (d) Any of the above.

8. If fluid level on the dipstick is between the ADD and FULL marks, you should:

- (a) Do nothing.
- (b) Add fluid until the level is at the FULL mark.
- (c) Look for leaks.
- (d) Perform a pressure test.



What do you do if you find particles of clutches and bands in transmission pan?

9. Low fluid level is caused by:

- (a) Improper filling of the transmission.
- (b) A leak.
- (c) Evaporation.
- (d) All of the above.

10. Inside surface of transmission pan has a dark overcoat. This indicates:

- (a) Normal operation.
- (b) Torque converter malfunction.
- (c) Particles from clutches and bands are clinging to the pan.
- (d) Interference between the transmission input and reaction shafts has led to overheating.

Answers

1. (b). Contaminants are purged from the transmission. The interior of a transmission must remain free of contaminants that cause spool valves in the valve body to jam and fail. When failure occurs, the transmission and torque converter have to be overhauled or replaced. Contaminants get inside a transmission through careless servicing. Keep dirt from the filler tube when removing and inserting the dipstick. Seat the dipstick cap fully to keep out water and other material.



What kind of service do you give magnet that's inside some transmission pans?

2. (d). Change transmission and filter on a regular basis. You are never certain if contaminants have entered the transmission. Thus, draining fluid regularly and changing the filter are necessary. Furthermore, in use, fluid loses its anti-oxidation capability that protects seals and gaskets.

The time schedule for changing fluid and filter varies from one manufacturer to another, and also from year to year with the same manufacturer. If a schedule is not available, set your own. We suggest every 24,000 miles under normal conditions, every 12,000 miles under heavy-duty operation (extended periods of idling or low-speed driving; towing a trailer; operation in dusty areas or in weather below 10° F.;

(Please turn to page 143)

Build a split-screen snorkel box

With this secret weapon you can shoot photos over and under water at the same time, the way the pros do.

by Neil Sander PM photos by the author



Mermaids, motors, any kind of marine action just under the surface can be caught on film with this viewing device that provides a sea-level-line outlook for a single-lens reflex camera while housing it safe and dry inside.

There's something spectacular about seeing under and above water level at the same time—showing both the fish and the fisherman, or a boat's bottom and topsides—all in a single picture.

To take such a shot, you might expect to need simply an underwater camera or conventional housing for one, but neither is enough. Water splashing against a cover plate immediately next to the lens will be out of focus and confuse the picture. In-

stead, you need a special enclosure that can give you a distinct waterline. Fortunately, you can build one yourself.

As photographer for Mercury Marine's saltwater test center on the Florida Gulf Coast, I have to record extensive engineering experiments, as well as how our engines and equipment work with a great variety of boats. Sometimes underway reports should show over and underwater performance in the same pho-

to. Since I couldn't find a manufactured over/under housing for my needs, I made my own.

If you build one, dimensions will be different (and smaller) than those shown here if you have a 35-mm, single-lens reflex camera. I wanted to use a $2\frac{1}{4} \times 2\frac{1}{4}$ -inch model for its larger picture size and viewing hood. If your 35-mm SLR does not have an interchangeable hood for right-angle focusing, you can get a right-angle

(Please turn to page 113)

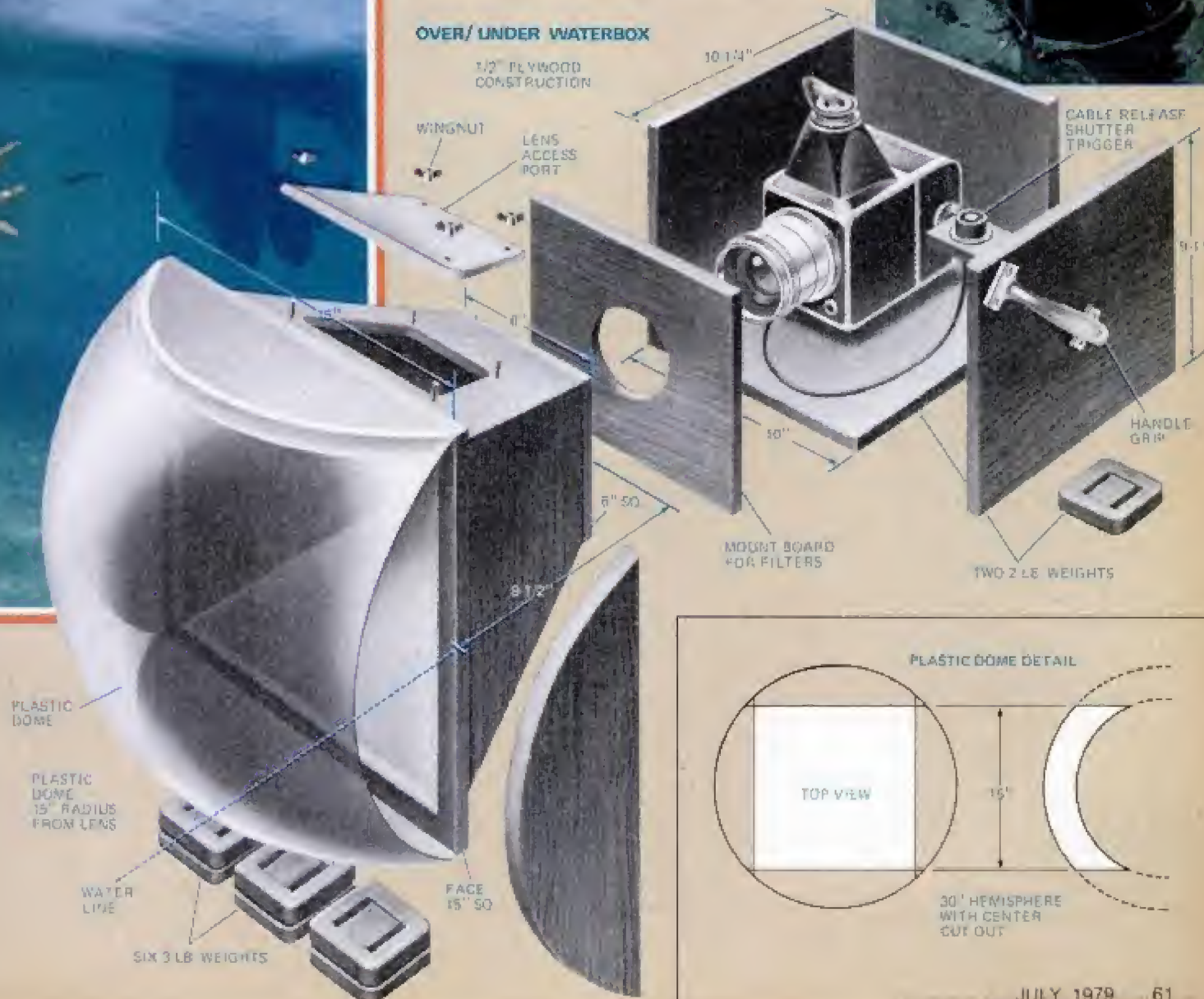


Getting set for the shot at left, photographer Sander focuses on models above and below surface, squats in water to balance rig and shoots (right).

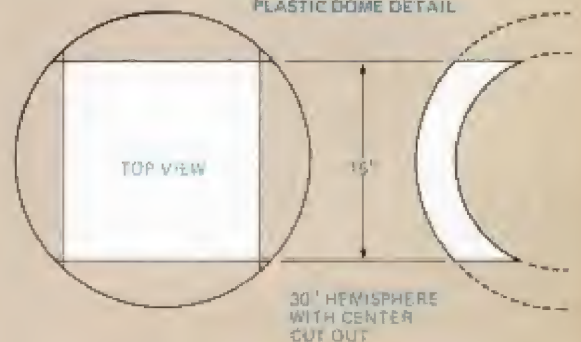


OVER/UNDER WATERBOX

1/2" PLYWOOD CONSTRUCTION



PLASTIC DOME DETAIL



Holy ragtops and *Return of the*

1979 Cadillac Seville started life as a four-door sedan in Detroit. Conversion to convertible is done by Coach Design in California, and the resulting ragtop is called the San Remo.



Yes, you can go topless!

by Wally Wyss

Once upon a time Detroit made convertibles. Now you have to get them elsewhere. The route to a ragtop is not always easy, quick or cheap... but what's nice is that you can still get that open car!

There are four ways to go:

1. You can buy a brand-new production convertible, one of the many still made abroad and imported here.

2. You can order a convertible conversion of a new Detroit car from a coachbuilder who specializes in top chopping.

3. You can have a vintage convertible professionally restored by one of the shops specializing in this type of re-do.

4. You can buy a completely assembled,



rollbars, it's the... **ROADSTER!**

Ford Mustang may show "1965" on its registration papers, but it has been made into a new convertible again by Beverly Hills Mustangs, Inc.



Lancia Zagato is one of the goodly number of new, production-line roadsters still being made and coming here from abroad.



soft-top kit car or you can build it yourself.

Remember, there's nothing illegal about convertibles. Roll-over protection is still just a *proposed* standard.

New convertibles

Even though American automakers have given up on convertibles, foreign automakers continue to make them and import them to the United States. Alfa-Romeo has one of the "pure" convertibles—one with no roll bar—the Spider Veloce. So does Mercedes, with the 450SL, and TVR with its two-seater. And Jaguar Rover Triumph has the Spitfire, MG Midget and MGB convertible, still much the same as they were a decade ago. New to the

fold is the TR-7 (see next page). The Aston-Martin Volante is a hand-built convertible that's now available here (for \$70,000).

The Targa top is a variation on the convertible—involving a roll-bar-like structure with a removable roof section. The Targa name was first used by Porsche in honor of its successes in the Targa Florio race in Sicily, but now many people use the name generically to describe that type of top. Porsche is expected to be in the market next year with a 924 Targa and, to compete with it, Alfa-Romeo may introduce an Alfetta Targa.

The new Volkswagen Rabbit convertible went on sale in Europe this spring. It's built by Karmann, the same coachbuilder that built

PM photo: Peter Samerjan

Driving the Triumph TR-7 convertible



At last! The TR-7 is now the car it always should have been. The tin top with its disconcerting backlight angle is gone (actually, the hardtop will continue to be made, but most sales are expected to be convertibles). The new top is a smart spread of canvas with a nicely raked, zippered plastic back window. If you've been ambivalent about the styling of the TR-7, you'll find that the lines of the soft top have a very positive effect indeed.

The TR-7 is a Triumph transformed by frame and canvas: It's better looking with its new top and a delight to drive with the top down. The car's interior—always a strong point, spacious and well laid out—seems even roomier when you drop the top. Our chance to do just that came when Jaguar Rover Triumph rolled its first U.S. models off the assembly line in Coventry, England. Too bad for us that it happened to be a cold day in February. It did, however, provide us with the opportunity to discover the secret of motoring, eccentric British style: We just cranked on the heat and blower and went about our business (of getting the photos here). The top-down/heater-on system works very well indeed, but we still wish the test drive could have taken place in the merry month of May.



Hidden headlights, sharp slope of hood and the clean front bumper are the elements that contribute to the TR-7's best angle, the head-on view above.

From the wheel of the TR-7 you can undo the two latches that secure the header of the convertible top and push it partway back. You have to get out of the car for the final fold and installation of covering boot, however.

With the boot clipped in place, you can get under way. Noise at speed is not so much from the wind whistling around your ears as from the Triumph Four. The 1998-cc, ohc powerplant with its twin Zeniths has muscle aplenty (85 hp @ 5500 rpm) but sounds and feels harsh. The smooth setup for TRs is the 3500-cc V8, now in the TR-8 hardtop and eventually to be offered in the convert. —B.H.



Two latches are undone and soft top is partially folded (top), final fold is made (above) and boot is attached to result in the TR-7's clean wedge shape (below).

TR-7 DIMENSIONS, CAPACITIES

Curb weight: 5-speed manual, 2427 lbs.; automatic, 2367 lbs.
Wheelbase: 85 in.
Overall length: 165.5 in.
Overall width: 66.2 in.
Overall height (top up): 49.5 in.
Track (front/rear): 55.5/55.3 in.
Ground clearance: 3.5 in.
Trunk capacity: 10.3 cu. ft.
Turning circle (3.88 turns lock-to-lock): 29.0 ft.
Fuel-tank capacity: 14.4 gal.



Rabbit color photos: Seinfelt



Volkswagen does it again: The Rabbit convertible — superbly crafted by Karmann in Germany—offers fun for four, even manages to tuck in a small trunk (below, right).



It's sun for four when the Rabbit's ragtop drops!

many Porsche 356 models, the Scirocco and is still building Beetle convertibles with padded tops. Rabbit's roll bar is a thin one and doesn't detract from the convertible feel. This summer, when you can buy one here, don't expect it to be cheap—the Rabbit convert will probably run between \$8000 and \$10,000.

Another type of convertible that fits none of the aforementioned categories is represented by the Lancia Zagato. The Zagato is a two-door car with two bucket seats up front and "occasional" seating

for two in the rear. It has a Targa-type roll-over hoop, but includes fixed side-window frames, unlike the Porsche. One can remove the roof hatch rather like a sun-roof. But it's got one more trick—a "drop-down," canvas-framed rear window. This lets rear-seat passengers enjoy the fresh air as if they were in a convertible.

This body style has been available on BMW 2002s in Europe (added by an after-market coachbuilder), but has only come to America recently on the Lancia

(Please turn to page 104)



Jaguar XJS roadster (above) is a teaser (Idea car) from Italian master Pininfarina. Shortened-wheelbase Seville (right) is by Milan Coachbuilders in California.



7 tests to help choose a color TV



Color bars are generated by professional test equipment. But you can do some quite adequate tests with just your eyes.



Blooming happens when the picture brightness has been turned up high. The color starts to smear and the clarity is lost.



Play with the set's tint or hue control and make certain that it can achieve a full range of color variation. You should be able to turn flesh tones green (top) at one end of the control's range and lavender (bottom) at the other. Normal flesh tones (middle) should appear with control near the center.



Blooming happens when the picture brightness has been turned up high. The color starts to smear and the clarity is lost.



A badly defocused picture may just show that the internal adjustments are out of line—or it may indicate poor design.



Cartoons are useful for checking the gray scale. When you turn off the color, you should see different shades of gray.



If you purposely defocus your TV set, a good AFT (Automatic Fine Tuning) control should bring it back into focus.

The tests mentioned in the text should help you find a good TV set. An important test

is that block letters (below) be shown crisp and clear with well defined edges.



Choosing a TV need not be confusing. First, we show you some easy in-store tests, then we give you the results of our own tests on over 40 models.

by Stan Prentiss

Believe it or not, there is no better time than now to buy a new color television set. The prices have stabilized and, in many instances, the quality is up. Solid-state circuits offer excellent energy conservation, along with added reliability—and many of the new modular receivers can be serviced right in your home at a reasonable cost.

But if you're not well acquainted with electronics, buying a color TV can be confusing and even frustrating. And few salesmen are expert enough to offer real help. But don't despair, we can give you a hand.

Find the right store

Find a store that offers a large assortment of TV makes and models. Pick out a suitable screen size (25-inches are really only for larger rooms). First, simply view comparably priced models to see how you like the pictures. Some may not be adjusted properly—have the salesman correct those. By the way, do not believe that 9- or 13-inch screens produce better pictures than the 17- or 19-inch models. You are seeing tiny picture elements crammed close to one another. The smaller picture may actually have the poorer definition.

Once you've selected the receivers that most appeal to you, ask the salesman to hook them all to an *identical section* of the store's master antenna. This way they will all be receiving the same signal.

Next, adjust each receiver for comparable levels of brightness, contrast, color and tint. Now you're ready to do your own consumer testing right in the store.

Blooming blues

Rotate the brightness control of a set from minimum to maximum. If the background should change from, say, brownish red to grayish white, you have discovered an abnormal response. It's possible the set is simply misadjusted internally, but there may be some design faults, such as poor high-voltage regulation and color temperature problems.

Double check an identical set. If

the problem persists, you have a "bloomer" on your hands; the set lacks special brightness limiter circuits. Blooming—poor focus response—is an indication of an inexpensively engineered TV. Stay away!

Highlights and low points

Turn the color control all the way down, as we now want to test the capability of the set to produce shadings of gray. You should be able to find intermediate settings of the brightness and contrast controls that will produce uniform shadings of black and gray over the entire picture. Cartoons, by the way, are very handy for this test. Use their sharp edges to check for picture sharpness.

If you turn the contrast up high and the picture darkens excessively, the internal setting of the AGC (Automatic Gain Control) may need adjustment. Again, check an identical set to see if it's just one unit at fault or a design deficiency.

Up and down, side to side

The vertical and horizontal sync circuits keep your picture steady and viewable. A rolling picture shows misadjusted vertical sync and a picture that has collapsed to the side shows poor horizontal sync.

The vertical and horizontal hold controls are used to regulate this sync. Familiar as these controls are, some sets may not have them. In fact, the better sets may offer special circuitry to automatically control picture sync. Such a TV is usually *highly* stable, so there is no need for user-adjustment controls.

If a set has vertical and horizontal hold buttons, set each to the midpoint of its range. When the set is turned on, or you switch channels, there should be no flipping of the picture or horizontal slanting lines. If you rotate either control—or



Test patterns, such as the one above, readily tell a trained technician all about a TV set. But a good pair of eyes alone can tell you if picture reception is okay.



Take along a mirror. It's a handy way to see a TV screen while making adjustments or tests at the back of the set.

both—to its left or right extreme, the picture should lose stability.

Color range and color lock

Turn up the color and set the tint control for the best-looking flesh-tones. See if reds become magenta (purplish red) or orange. If so, the set does not offer true color. If the set passes so far, swing the tint control from one end of its range to the other. The flesh tones should go from lavender to green.

Now, turn the color all the way down and begin to bring it up slowly. Look at the entire picture for uniformity of response. Watch out for little flecks in the picture as the control is rotated upward. Also watch that specific colors do not begin to blur.

Tuner and remote controls

The tuner is the last thing we will look at—but far from the least important! Many servicemen call it the *front end* and it can tell you a great deal about what goes on in any set.

Turn off the AFT (Automatic Fine Tuning). Then turn the manual fine tuning control about a half turn from the center. The picture should be distorted and lose color.

Now switch the AFT back on. See if the AFT's pull-in range is enough to correct your deliberate mistuning and turn the ruined picture back into an acceptable one. Of course, you cannot have wildly mistuned the set, but the AFT should work within reasonable limits. If the set fails this test, once again check an identical set.

For a final test, once again turn off the AFT. Tune the set for best picture, sound and color. Now go from channel to channel, looking for a poor, snowy signal. If you then compare reception with that of oth-

SELECTED COLOR TELEVISION RECEIVERS

Maker	Chassis	Model	Cabinet	Suggested Retail	Picture Tube (in.)	Video	Color	Comb Filter	VIR	Remote Controls	Home Serviceability
Admiral	M50	19C7078	table	\$499	19	very good	good	no	no	no	good
	M50	19C708BRA	table	549	19	very good	good	no	no	yes	good
	M50	19C709BRA	table	699	19	very good	good	no	no	yes	good
General Electric	YC	19YC9762K	table	500	19	good	very good	no	yes	no	very good
	YC	19YC9764H	table	535	19	good	very good	no	yes	no	very good
	YC	19YC9766D	table	535	19	good	very good	no	yes	no	very good
	YC	19YC9772R	table	650	19	good	very good	no	yes	yes	very good
	YC	19YC9774L	table	685	19	good	very good	no	yes	yes	very good
	YC	19YC9776D	table	685	19	good	very good	no	yes	yes	very good
	YM	25YM9880C	console	1000	25	very good	very good	no	yes	yes	very good
	YM	25YM9820R	console	750	25	very good	very good	no	yes	no	very good
	YM	25YM9832M	console	800	25	very good	very good	no	yes	no	very good
	YM	25YM9845K	console	850	25	very good	very good	no	yes	no	very good
	YM	25YM9870K	console	960	25	very good	very good	no	yes	yes	very good
Magnavox	TB09-05	4345	table	600	19	excellent	very good	yes	no	no XMTR	very good
	TB09-05	4471, 5, 7	table	700, 730	19	excellent	good	yes	no	no XMTR	very good
	T815-02	4640	console	850	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4660, 2, 4, 6, 8	console	900	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4674, 6	console	950	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4688	console	995	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4811	console	950	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4821	console	995	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4841, 5, 7	console	1095	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4855, 7	console	1095	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4859	console	1295	25	excellent	very good	yes	no	no XMTR	very good
	T815-02	4891	console	1295	25	excellent	very good	yes	no	no XMTR	very good
Panasonic	NMX-LIA	CT-980	table	590	19	fair	fair	no	no	no	no modules
RCA	CTC93	FC49BWR	table	580	19	fair	very good	no	no	yes	no modules
	CTC92	FC530WR	table	760	25	good	good	no	no	yes	very good
	CTC92	GC7025	console	730	25	good	good	no	no	no	very good
	CTC92	GC7305	console	790	25	good	good	no	no	no	very good
Sony	SCC-173-AA	KV-1542R	table	600	15	very good	good	no	no	yes	no modules
Zenith	19KC50	K1924W5	table	450	19	very good	excellent	no	no	no	very good
	System III	K2522E	console	790	25	very good	very good	no	no	no	excellent
	System III	SK2523E	console	890	25	very good	very good	no	no	yes	excellent
	System III	K2512W	table	630	25	very good	very good	no	no	no	excellent
	System III	SK2513W	table	730	25	very good	very good	no	no	yes	excellent
	System III	K2534X	console	840	25	very good	very good	no	no	no	excellent
	System III	SK2535X	console	940	25	very good	very good	no	no	yes	excellent

Warranties for the above sets are nearly identical: 90 days on labor, one year on parts and two years on the picture tube. Keep in mind that we tested the chassis of different manufacturers. The same chassis may be used in more than one TV model. We give you a few

model numbers that contain each chassis we tested. If the model number you are considering is not listed here, check the TV's schematic to see what chassis it uses; the same chassis may be in many models.

er sets tuned to the same channel (each with its AFT off), you will have a relative check of each TV's front-end sensitivity.

If you are contemplating a remote-control set, you have several options. There are remotes with double-keyboard number selection, others on which you follow one or two digits with a push of the "select" or "enter" buttons, and one with an up-down control that selects channels in a smooth sequence.

Look for the phase-locked loop models from General Electric or Admiral. In these, the remote control unit actually senses if the TV is slightly mistuned and will compensate for it.

Feature or gimmick?

You will see a lot of "new" circuits and devices advertised. Some are just new names and some are nonsense, but others are real advances.

Magnavox is featuring a new 25-inch receiver with optional *comb fil-*

tering—a funny name for a very useful feature. Using it, a TV set can display 300 lines of horizontal resolution instead of the more normal 240. This can give you a wealth of visual detail. The option is available on Magnavox's T-815 chassis. (That's *chassis*, not a set model number. Many different sets will use the same chassis. Usually the chassis number is listed on the schematic diagram that is provided with the TV set.)

General Electric offers a VIR system (Vertical Interval Reference). Essentially, VIR recognizes information that is encoded on an incoming signal, then uses the information to lock the set's tint and color to that of the transmitting station. Many sets will offer this feature in the near future.

Both Zenith and Magnavox are using a Zenith-Rauland 25-inch inline picture tube with vertically striped phosphors. It produces excellent overall resolution and good center focus.

End of hunt

So you have finally picked out your dream TV—now, here's more good news. The new solid-state TVs average no more than one failure every two years, which is only one-fourth as many failures as the older tube sets had. But many silver linings have a cloud—and here's the bad news. Repair costs are keeping pace with inflation. A typical repair runs between \$60 and \$80. Naturally, charges vary according to service performed.

Still, you're better off buying a new set than trying to keep one of the older ones in repair. Pay \$255 for a new picture tube on an old set and you still haven't made any of its hundreds of other parts any the newer.

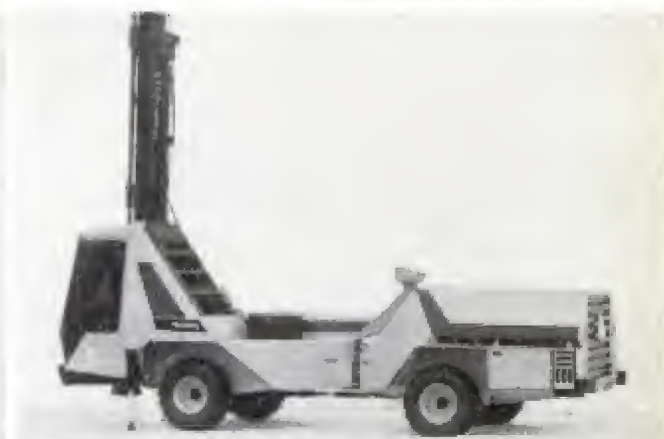
The time to buy is now. Not only can you perform the tests we've explained; you can also consult the chart above for a technical analysis of many sets that we checked in the laboratory. Good luck, and good viewing.

ITS NEW NOW

Easier blast-hole drilling

Drilling blast holes is no fun if the machine can't reach the drill site. The BD-20 Blast Hole Drill (right and top photos), built by Ewbank Manufacturing Div. of Fairview, Okla., has an articulated chassis and all-wheel drive to drill where conventional units can't. Three hydraulic pumps coupled to a six-cylinder diesel engine drive the machine. Originally required to drill 30 17-foot blast holes per hour, the BD-20 can drill close to 45. An enclosed cab houses controls and provides increased operator safety. The rig has a 14-foot wheelbase and weighs about 12.5 tons. The drill boom is about 22 feet high.

The Krupp Company of Germany makes a drill (bottom photo, right) with similar performance to the BD-20 but a different design. The Krupp unit uses a back-hoe-like boom to extend the drill into hard-to-reach areas. It also has an air-flushing and suction system to clear shattered rock. Krupp says the machine does as much work as seven conventional ones.



Pollution-free car from Japan runs on hydrogen



A car fueled by liquid hydrogen was recently driven in Japan at an average speed of 25 to 30 mph. One designer, a professor at Musashi Engineering University of Tokyo, said the speed could be boosted to 70 mph. He said the hydrogen system could be commercially viable if its pressurized fuel tanks can be mass-built. The car's engine displaces 550 cc.

Just don't throw any stones

Proving you can have elegant looks with assembly-line economy, this German prefab home features large expanses of glass, deep roof overhangs and spaciousness despite its small size (750 square feet). Roominess comes from open-plan design with a single living-dining-cooking area, plus balcony, bedroom and bath upstairs.



New for jogging

Special gadgets and stylish gear add tone to popular fitness sports and the relaxing games of summer.

Remember when all you needed for outdoor sports gear were old clothes and sneakers? Now, jogging has gone the way of skiing, boating, tennis and so many other sports for which complicated gear is a must. You need to impress your friends and improve your form with the latest in equipment. Ability and hard work simply aren't enough.

From the ground up, jogging shoes have specially cushioned soles to cushion pavement pounding, and may even have a new "shoe pocket" tied into the laces to hide keys, money and an I.D. card. Socks may be topped with strap-on weights to intensify the exercise.

Weight belts may also be worn, though there are many other options, such as a backpacker's "fanny pack" to hold rain jacket, sunglasses, sweater and camera or stopwatch. Bodabelt Products has a money belt with built-in pint or quart-size bladders for your beverage. It's \$14. The Digi-Jog clips on this busy belt, set for your length of stride, and reads off up to 99.9 miles. Joggeradio, from Jog-a-Lite, Silver Lake, N.H. 03875, \$25, belt-mounts and plays through an earphone, or you can use the Cronus Strider, also \$25, which, when adjusted for your stride and the speed you want, gives earplug beeps that pace you to a pre-



Set a runner's speed with \$25 Strider from Cronus Precision Products, 2895 Northwestern Pkwy., Santa Clara, Calif. 95051.



Read pulse instantly on Heart Rate Indicator by Apollo Fitness Programs, West 10th Mission, Spokane, Wash. 99210.



With built-in plastic pint or quart bladder, \$14 Bodabelt is from Bodabelt Products, 288 Douglas Ave., Boulder Creek, Calif. 95006.



Set for runner's stride, Digi-Jog logs distance. Gutmann Co., 900 South Columbus Ave., Mount Vernon, N.Y. 10550. \$17.50.

...or avoiding it!

selected time per mile. Ultimate for sound effects may be the \$200 Aspen 360 from Cosmic Innovations, Box 10161, Aspen, Colo. 81611, a padded rechargeable stereo player with earphones that belts on runners, skiers, and hang gliders to pour out taped cassettes of instructions, encouragement or inspirational music to enjoy while exercising.

Joggers can select from enough wrist radios and pace-setter beepers to delight Dick Tracy. One radio, \$17 from Radio Active, Box 233, Naperville, Ill. 60540, can fit in the back of a terrycloth headband.

Monitoring pulse rate

A \$189 wand, the Insta-Pulse from Sharper Image, San Francisco, Calif. 94101 is held in both hands to give a pulse-rate reading in LED digits. Only a finger is necessary to activate the Apollo \$130 Heart Rate Indicator and tell when you are about to reach the 70 to 80 percent of your age-adjusted maximum that is considered most beneficial for a healthy workout.

Wrist and neck-strap watches are in profusion for jogging against a clock. Colorful shorts, T-shirts and sweat suits are now styled in any hue you can name. For inevitable strains and pains that are part of the sport, 3M has a new reusable Cold/Hot Pack to treat spots that hurt.

A lot of exercisers have decided they don't require the one-for-the-road race to stay in shape, and makers have been pouring out new games in agreement. Running in

place is rated more fun on the Jog-N-Tramp, a mini-trampoline, \$189 and only 8 inches high and 38 inches wide, that can be used both indoors and out to keep in shape.

Dozens of back-yard and lawn games are being introduced to use less expensive plastic equipment, and many are planned with practice elements for baseball, basketball, tennis, racketball and skiing for lat-

er in the season. Exercise bicycles can now measure energy expended, pulse and percentage of exertion level. You should, of course, receive a doctor's okay before you use one.

And don't overlook the new hammocks and lawn chairs; all hold you comfortably until the urge that compels you to exercise finally passes. **FM**



Saucer Golf, a way for Frisbees to go competitive in the back yard, is from Saucer Golf Inc., 3775 North Dunlap, St. Paul, Minn. 55101. "One hole" game can be set up for \$219.



A running and catching game that takes little gear is Crazy Kones, \$4.50 by Cosom, Box 1429, Minneapolis, Minn. 55401.



Ultimate in sit-down stress test may be \$4000 Pedalmate Ergometer bike. Collins, 220 Wood Rd., Braintree, Mass. 02184.



Winter sports practice are aim of gadgets like Ski Shape, \$31.50. Major Sports Sales, Box 1385, Los Altos, Calif. 94022.

Chrysler Corp. aims the Plymouth Champ and Dodge Colt hatchbacks directly at young buyers and those who place a high priority on economy.

Yet Chrysler—along with the manufacturer of these two cars, Mitsubishi—realizes that economy sells best when teamed with performance. So, that's the concept behind the Champ/Colt's Twin Stick transmission: performance in low range and economy in high.

Twin Stick was an option when these cars were first introduced. Now it's standard, and 75 percent of the Champ/Colt owners we surveyed had ordered it.

Drivers of Twin Stick-equipped Champ/Colts averaged 0.10 mpg more than those without it—hardly a significant factor. So, while there's no doubt that the Twin Stick aids performance, there's some question about its ability to effect

PM OWNERS REPORT: DODGE COLT HATCHBACK AND PLYMOUTH CHAMP

great improvement in fuel economy.

Economy, however, led as *THE* overwhelming reason for buying one. A California naval officer comments, "Our old car had worn out. We saw the Colt. It looked cute and practical, and it's turned out to be economical as hell. Peppy, too!"

A New York truck driver says, "We bought our Champ primarily for economy, but the superb construction impressed me when I compared it to other small cars. I also wanted to try front-wheel drive."

An Illinois cook: "I wanted a really economical car that had some zip to it. The Twin Stick transmission gives me that."

A Florida retiree: "I need an economy car, since I'm on a fixed income. The Twin Stick seemed like a good idea. Now that I've had the car a while, I'm convinced they'll soon put this transmission into other cars."

Not that economy was the only reason for purchase. A New York hardware clerk



Optional instrument package (not shown) mounts ammeter, oil gauge on console.

notes, "After driving the Datsun F-10, VW Rabbit and Champ, I found the Champ to have greater pickup, less noise and superior handling. It also struck me as more comfortable and better looking."

But a New York sales manager drives home a painful point when he writes, "I bought this Champ because I foresaw the



Champ/Colt weighs less than 2000 lbs., has large glass area for excellent visibility.

BY MICHAEL LAMM WEST COAST EDITOR

Twin Stick offers increased performance, but doesn't aid fuel economy much

Standard dual mirrors have electric adjusters.

Hatch reveals 13.7-cu.-ft. cargo area when seatback is folded.

Front-wheel drive is highly praised for bad-weather traction.

PM photos: Charlie Lamm

great price increase in gasoline and figured I'd better unload my 1977 440-cu.-in. Cordoba guzzler before it was too late."

Our survey uncovered very little difference in overall fuel mileage between the 1.4- and the 1.6-liter engine. In fact, the Champ with the larger engine actually got *better* mileage than its less powerful brother. Taking an overall average, the Champ/Colt's in-town mileage came to 30.05 mpg, and on the highway they got

an even more impressive 36.63 mpg.

For some reason, Champ owners appreciated the performance of their cars more than the people who'd bought Colts. A few more Colt owners chose the smaller engine, but not enough to account for the difference. Perhaps the reason lies in the fact that a greater percentage of young people bought Colts than Champs.

On the general topic of performance, we logged these comments: "I find the power range excellent for passing on the freeway. It's a fun car to drive."—Alabama investigator.

"My Champ feels great to drive. The Twin Stick (power-economy) adds so much to the car's acceleration. And the styling is sexy and neat."—North Carolina speech therapist.

"The Colt has great gas-pedal response and gets up to speed in a hurry—more than expected in an economy car. I'd previously owned a British sports car, so that's important to me."—California real estate agent.

Front-wheel drive, too, got a number of pats on the back. Several Midwesterners remarked that twd got them through the blizzards of last winter. Skiers appreciated the fact that they didn't have to stop to put on chains. And general handling on ice, snow and wet streets brought out considerable praise. In all, an average of

(Please turn to page 128)

Two new MoPar minimates

After long ignoring the minicar market, Chrysler Corp. recently jumped into it with both feet. Its stable of automobiles now includes the Omni, Horizon, Arrow, Challenger, Sapporo, Colt, Colt hatchback and Champ.

We'll focus here on the Plymouth Champ and Dodge Colt hatchback—two new stablemates made by Mitsubishi in Japan and brought here by Chrysler.

The Colt and Champ are identical under the skin and look very similar outwardly. The Colt's grille uses a rectangular mesh, while the Champ's consists of thin horizontal bars. That, plus beltline graphics, represent the major differences.

Both cars use a 1.4-liter ohc Four—mounted transversely and with front-wheel drive—as standard equipment. A 1.6 is optional. Net horsepower rates 70 and 80 respectively. These Mitsubishi engines use the MCA Jet third-valve principle, which swirls in extra air for more complete combustion.

Both cars now are marketed with Twin Stick overdrive transmissions, though not all cars had Twin Stick at the time of our survey. This amounts to an additional shift lever, which changes the final transmission ratio from 1.11 to 0.86:1. Thus, you can use low range for power and high range for economy.

Options available include airconditioning, Custom and Sport trim, more complete instrumentation and several different wheel/tire combinations.



Front seating, legroom get good marks, but pedals are small for big-foot drivers.

A NATIONWIDE SURVEY BASED ON 1,296,827 OWNER-DRIVEN MILES

Colt and Champ share 90.6-in. wheelbase, unit body, coil-spring suspension.

Slope begins behind rear passengers' heads.



Sport wheels, steel-belted radials are optional.



Roof continues straight behind rear passengers, giving them ample headroom.



Twin Stick, now standard, used to be optional, improves mileage only 0.10 mpg.



Rear legroom, on the other hand, presents problems to the car's long-legged riders.



With rear seat up, the hatch accepts 6.9 cu. ft.; with it down it takes 13.7.

New cameras: smaller, lighter, more versatile



Agfamatic 901E 110 camera has built-in motorized film advance for single frames or continuous shooting.

Electronics and clever design cram more features into smaller packages.

Last year was the most successful ever for the photographic industry, but no one is resting on any laurels. This year the industry seems determined to lure more and more people into taking more and more pictures by making the process easier and more convenient.

Most major single-lens-reflex manufacturers (including Nikon!) have come out with new compact, automatic cameras, all listing for about \$400. But of wider interest are new products from the makers of 110 and 35-mm cameras. They're putting more features into their cameras and making them smaller. For example, the Minolta Autopak 460T (\$117) includes built-in flash, slide-in telephoto lens, variable focusing and three-position exposure

control. It measures less than $7 \times 2\frac{1}{2} \times 1\frac{1}{4}$ inches.

Much smaller (and with fewer features) is the Voigtlander Vitoret 110EL (\$66). At $4\frac{3}{4} \times \frac{5}{8} \times 1\frac{1}{4}$ inches, it shouldn't be put in a pocket with a hole in it. It's a fixed-focus unit, with two aperture settings and a programmed shutter ranging from $\frac{1}{500}$ to 4 seconds. A companion add-on flash is available.

The Agfamatic 901E has one feature sure to appeal to the American market: built-in motorized film ad-

vance. It can be set for single-shot use or will keep shooting as long as you keep the shutter release depressed. It measures less than $5 \times 2\frac{1}{4} \times 1\frac{1}{4}$ inches and costs about \$170.

Two other 110 camera trends seem to be picking up momentum as well. The Keystone 66S (\$108 with flash), like the Minolta 110 Zoom and the Fujica 350 Zoom, has—what else?—a zoom lens. Zoom range is 25 to 42 mm, aperture range is f/5.6-f/16 and there are two shutter speeds. Size is

Tiny Voigtlander Vitoret 110EL (top right) features programmed shutter and add-on flash. Minolta Autopak 460T (middle right) has built-in flash and slide-in telephoto lens. Keystone Zoom 66 (lower right) sports 25-42-mm zoom lens. Vertical-format Hanimex VIF 110 (left) is designed to be held more securely to reduce chance of camera shake.





The Ricoh FF-1 35-mm camera (left) folds flat for easy pocketability.

Olympus XA 35-mm (above) features rangefinder focusing in a small package.

4 $\frac{3}{8}$ × 2 $\frac{3}{8}$ × 1 $\frac{1}{2}$ inches, and flash is available.

Don't mistake the Hanimex VIF 110 (\$60) for one of the 35-mm cameras it resembles. It's one of a growing number of vertical-format 110s designed to reduce camera shake. The vertical configuration is supposed to make it easier to hold the camera steady. The Hanimex has built-in pop-up flash and is easily pocketable.

In 35s, the autofocus parade goes on, joined by Fujica and Yashica.

But the big news has to be the new super-small cameras from Ricoh and Olympus.

The Minox 35EL (succeeded now by the 35GL) is still the smallest full-frame 35-mm camera, but not by much. At 4.2 × 2.37 × 1.2 inches, the Ricoh FF-1 is only slightly bigger. Like the Minox, it has a fold-down front lens cover and retractable lens. It features a programmed automatic shutter (range $\frac{1}{500}$ second to 2 seconds), 35-mm f/2.8 lens, single-stroke film advance and hot shoe.

With the lens set in a special automatic mode, optimum aperture and shutter speed are automatically selected. The FF-1 lists for \$255.

Not to be outdone, Olympus has introduced the XA, which is larger than the Ricoh (4.02 × 2.52 × 1.56 inches), but still fits in your hand. A sliding clamshell

lens cover activates the metering system and protects all optics. Despite its size, the XA has one feature the other two don't—rangefinder focusing. You have to guess with the others (not difficult). The XA has aperture-preferred automation, a back-lighting compensator button, "feather touch" shutter release and a self-timer with both audio and visual indicators. Like the Ricoh, it has a 35-mm f/2.8 lens. An add-on flash is available. Camera is \$200.

Lens sizes reduced

While camera lenses have not benefited directly from the new microelectronics, computer-assisted lens design is helping reduce their size and weight. There's been an explosion of amazingly compact zoom, telephoto, normal and wide-angle optics. Two examples illustrate the trend.

From Tokina comes a 28-85-mm f/4 (Please turn to page 132)



A harbinger of even wider zoom ranges, Tokina's 28-85-mm f/4 zoom comes close to being a universal lens.



Only 2 $\frac{1}{16}$ inches long, Minolta's 250-mm f/5.6 mirror telephoto is only $\frac{1}{2}$ inch longer than firm's 50-mm f/1.4.



Servo-controlled dial on Vivitar 260LX hand-held meter omits moving needle.

Skip over those mopeds... Get the jump with a

The best two-wheelin' starts with your first *real* bike. by Eugene A. Sloane

When you're ready to add a little engine to your two-wheeling fun, you can start with the smallest of small—a 49-cc moped—or with a light motorcycle—one from 70 cc up to 250 cc.

Perhaps you think that a motorized bicycle will be enough of a two-wheeler for you. Maybe so, but we just want to make sure you don't make the purchase and regret it (like all those salts who quickly found that their first boat was too small, underpowered, or both!).

Fuel mileage of a moped is great—easily over 100 mpg—but that's its only advantage over a small motorcycle, we think—especially as state registration and other red tape makes moped ownership as complicated and expensive as owning a motorcycle. Those moped pedals, incidentally, are worthless: we think it's easier to push a light motorcycle home if it quits than pedal a moped!

A light motorcycle gives you a license to *ride*—to have as much right to the road as any motor car.



Kawasaki KZ200 takes the lead away from the Honda CB125S on a frolic through the California hills—hills that would be insurmountable on a moped. Both bikes are pure street machines—not dual-purpose, off-road, on-road types.

Instrumentation and lighting on a small motorcycle is far superior to that found on a moped.

small motorcycle!

You can cruise at 55 mph on any road, and you can do it with a passenger on the back of your bike. You have the power you need at your right wrist to make your moves smartly in the traffic mix, and your suspension, brakes and lighting provide comfort and safety.

The pricing structure, too, is in your favor if you consider a small bike instead of a moped. Mopeds are running \$400 with prices up to \$750 for the fancier models (ones with adequate shocks!). Small mo-

Motorcycle brakes, whether front disc/rear drum (like right on Kawasaki KZ200) or drum/drum as on most small motorcycles, give you safe stops.



Strong output of 200-cc Single on Kawasaki lets you run where mopeds can't.



PM photos: David Gooley

An easy bike to straddle and control if you're on the petite side is the Honda CB125S. Seat height is 29.9 in.; weight is 207 pounds and price is only a few hundred more than a good moped. When you grab a handful of the power that 125 cc delivers, you'll move out with the quickest traffic, but won't risk a wheelie backflip.





For tangling with traffic, light motorcycles have power to scoot and heavy-duty brakes.

motorcycles start around \$700 for 100 cc and go up to \$1400 for a substantial 250-cc machine. So, for only a few hundred more, you can be riding, say, a tough, 125-cc motorcycle instead of a putt-putt bicycle.

Selecting a small motorcycle

Although we include 70-cc bikes in our small-motorcycle category, anything under 100 cc is really suited only for gunk-holing around town or for use on campus. For serious commuting we'd use nothing smaller than a 100-cc bike. The bigger the

bike the more comfortable it is to ride, so if you commute upwards of 20 miles or so one way over bumpy roads, a 100-cc to 200-cc street bike would be best.

The accompanying photos show two "pure street machines" designed for the road only. The other alternative is the combination off-the-road/street-legal bike which has knobby tires, upswept muffler with spark arrester, and lots of room between fenders and wheels for bouncing around. However, these street-legal bikes do not handle well on the road, the knobby tires give poorer traction on pave-

ment, and the ride is harder than a pure street bike. Still, if you want a small bike to bound around the farm or ranch and yet one that will get you to town at a respectable speed, a trail-or-street bike is a good choice.

Light motorcycles use both two-cycle and four-cycle engines. Two-cycle engines have an oil-injection system, while the four-cycle machines usually have a crankcase so you don't have to add oil to the gas. The three pure street machines on the market all have four-cycle engines. The Kawasaki KZ200 is a single-cylinder machine light enough (only 278 pounds) to be easily maneuvered in traffic. Braking is excellent thanks to front-wheel disc and rear-wheel drum brakes. The 2.46-gallon tank should get you at least 150 miles per fillup. The motor generates 18 hp at 8000 rpm.

Second is the Honda CB185T two-cylinder bike. The two-banger motor has less vibration than the single-cylinder Kawasaki, and it has a lot more moving parts and gives less power. However, the differences are minor. The CB185T seat height is only 28.7 inches from the ground (vs. the Kawasaki KZ200's saddle height of 30.3 inches), so it should be better for smaller riders.

There's only one other pure street bike available, and that's Honda's CB125S, a one-lunger, 125-cc model. This is a small bike, to be sure, but it's big enough to stay with the 55-mph legal speed limit with ease, and fast enough on the takeoff to stay with city traffic. You should get about 80 mpg from this model.

Dual-purpose, on- and off-road, street-legal motorcycles generally have upswept arrester mufflers (required by many states to avoid forest fires), wide fender clearances, long-travel shock absorbers, long wheelbases and stiffer rides than street bikes. In the small bike category, they come in 70-cc to 250-cc sizes. Which one you buy depends on how much power you need. If you want to do a lot of trail riding over hilly, rough terrain, a 250-cc model would be best, particularly if you carry camping gear. On the other hand, an 80- or 90-cc machine with a seat height of about 25 inches is fine for youngsters or shorter people who want to get around the farm or ride short distances on and off the road. Check the specifications for the model you need. All the dual-purpose bikes listed in the chart on this page will give you excellent service within their limitations of size and horsepower.

Safety

Before wheeling any small bike (even a moped) into traffic, you should take a safe-riding course at a local high school, college or private riding school. At the very least, practice on quiet streets or on a vacant parking lot for a hundred miles or so until your handling of controls, brakes,

(Please turn to page 97)

SPECIFICATIONS—STREET-ONLY MOTORCYCLES*

Maker	Model	Engine Size (cc)	Engine Type (cycles)	Transmission (forward speeds)	Length (in.)	Width (in.)	Seat Height (in.)	Dry Weight (lbs.)
Kawasaki	KZ200-A2	198	4	5	75.6	30.7	30.3	278
Honda	CB185T	181	4	4	77.2	32.7	28.7	273
Honda	CB125S	124	4	5	73	29.3	29.9	207

* These are pure street motorcycles; ideal for commuting and short-haul trips.

SPECIFICATIONS—DUAL-PURPOSE MOTORCYCLES†

Suzuki	TS-250	246	2	5	86.2	34.3	N.A.	260
Kawasaki	KL250-A2	246	4	5	86	34.4	33.1	276
Honda	XL250S	249	4	5	85.6	34.4	33.5	260.1
Yamaha	DT250F	246	2	5	86	34.3	33.7	270.6
Honda	XL185S	180	4	5	81.9	33.5	32.3	232.6
Yamaha	DT175F	171	2	6	82.5	33.5	32.5	216
Yamaha	DT125F	123	2	6	82.5	33.5	32.5	212
Honda	XL125S	124	4	6	81.9	33.1	32.3	229.3
Yamaha	DT100F	97	2	5	74	31.5	28.7	176.4
Kawasaki	KE100-A8	99	2	5	78	33.9	31.7	203
Suzuki	TS-100	98	2	5	79.3	32.9	N.A.	201
Kawasaki	KM-100-A4	99	2	5	68.1	30.1	27.6	172
Honda	CT-90	90	4	8‡	73.6	29.1	30.5	198.5
Yamaha	GT80F	72	2	4	61.6	27.9	25.8	141
Honda	CT70	72	4	3	59.6	26.4	29.1	156.4

†All dual-purpose models have headlights, front and rear turn signals, and otherwise comply with state regulations for street-use motorcycles. All have high fender/wheel clearance, upswept mufflers, rear brackets to hold license plates, and high ground clearance for off-road and trail use.

‡Four low-range speeds and four high-range speeds.

Rolling shutters help cool this home



Problem: How do you cover a 6-ft.-wide, sliding-glass den door with something decorative and energy-saving? Solution: New Pease rolling shutters, which are installed outside the door, but can be operated from inside the room.

The shutter, made by the Pease Co., Ever-Strait Div., New Castle, Ind. 47362, conserves energy by trapping air between itself and a window (or glass door), thus creating a dead-air space which serves to insulate the room. The shutter is made of hollow PVC extrusion—another dead air space which helps to insulate.

In hot weather you can close the shutters during the day to prevent radiant heat entering. Open the shutters at night after the temperature drops to admit cool evening air. In cold weather, open the shutters during the day; close them at night.

Shutters are available in sizes to fit double-hung or sliding windows and patio doors. Prices range from \$175 for individual window shutters to \$400 for ones to cover sliding doors, as shown.—*Stefan E. Brett*



Exterior-mounted rolling shutters cover this 6-ft.-wide sliding glass door between den and deck. Shutters lower heat gain in summer, heat loss in winter, protect glass from hail or sleet, afford full privacy.

PM photos: Julius Spedale and the author



Nail 3/4-in.-thick wood strips at sides and top of door opening (left). Test-position shutter rails on strips, use level to be sure rails are plumb (right). This will insure smooth shutter operation.



Bore holes in wood strips and attach shutter rails with screws (left). Locate place for strap to operate shutter; bore through filler, siding and wall (right).



Lift shutter assembly and attach it with screws to the horizontal filler. In the project shown, two shutters separated by a center post are installed.



After installing the hand strap mechanism to operate shutters, thread the slats in the side rails; secure top shutter cover.



Final step of the installation is caulking the top and both sides of the shutter perimeter in order to seal the unit.



**In and out,
up and
down.**

PM's LADDER

Durable and versatile,
this climber can be
built entirely
with handtools.



1



2



3

1. Design inspires all sorts of activities—including game of peek-a-boo with photographer.
2. Platforms are removable.
3. Kid's-eye view of climber from above.

CLIMBER IS A WINNER

by Paul Levine

We call it a ladder climber, and it's reminiscent of the monkey bars found in so many playgrounds. But let your kids—and their imaginations—loose in it and it becomes a desk, a jail, a fort, a space capsule, a computer console or . . . you name it. The unit's movable platforms facilitate the transformations.

To build the climber, all you need are some basic tools and the materi-

als listed below. Bonus: If you're short of space, it folds flat for easy storage.

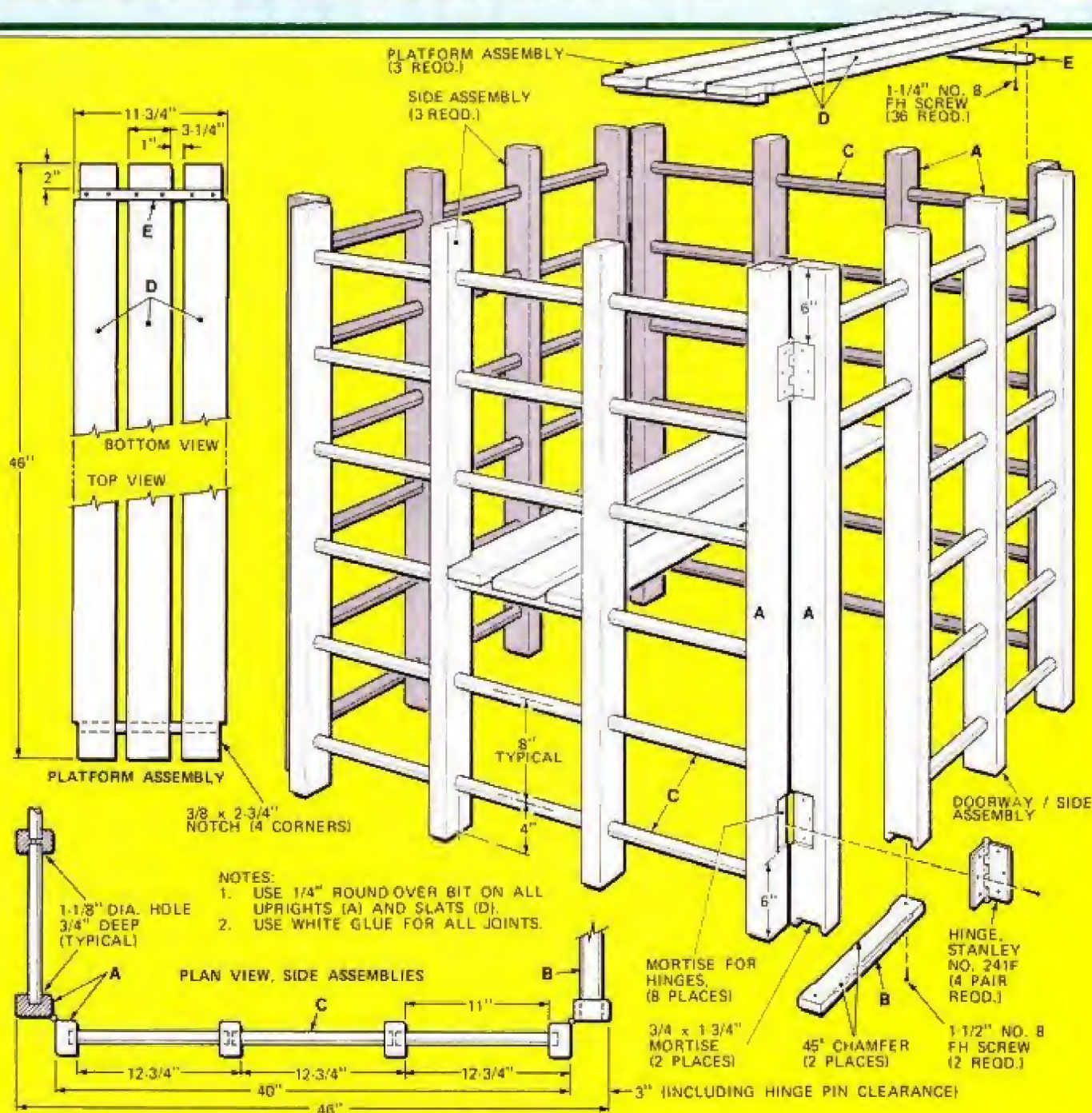
Begin work by cutting uprights (A). Round edges with a block plane or router and 1/4-in. rounding-over bit. Then sand them smooth.

Choose eight uprights for corner pieces and mark them for future identification. Position hinges on the uprights and trace their out-

lines. Remove the hinges and use a chisel to make the mortises.

Make centered marks on the uprights where the rungs (C) will attach. Remember to leave a blank space for the doorway. Bore holes for the rungs with a brace and bit or use a drill and power bits. Cut the rungs to length.

Assemble the sides using pipe
(Please turn to page 96)



MATERIALS LIST—LADDER CLIMBER

Key	Pcs.	Size and description (use)	C	68	1 1/4"-dia. x 12 1/2" hardwood dowels (rungs)
A	16	1 1/2 x 2 1/2 x 48" poplar (uprights)	D	9	3/4 x 3 1/4 x 46" red oak (slats)
B	1	3/4 x 1 1/4 x 14" red oak (saddle)	E	6	3/4 x 3/8 x 11" red oak (cleats)

Misc.: 4 pr. 241F brass-plated Stanley hinges, white glue, 2 No. 8 x 1 1/4" fh brass screws, 36 No. 8 x 1 1/4" fh brass screws.
Note: Standard 2x3 can be substituted for pieces A.

Kit cannons to build for the Fourth

You can get a real bang from these time-honored guns.

by Angus Laidlaw



Field artillery on both sides in the Civil War relied on the smoothbore Napoleon cannon. Modeled after bronze 12-pounder originals, this CVA kit copy has a 14½-inch steel barrel, weighs 17 pounds.



Fit on the barrel, add water and powder, push the plunger and the old-favorite carbide cannon will still fire a loud but safe salute.



Replica of an antique timepiece, the sundial cannon model is solar-energy activated as concentrated sun rays fire it off.

Booming across the land, cannons have welcomed the Fourth of July every year since the founding of our country. Today you can still don a Revolutionary or Civil War uniform and join an artillery company that re-enacts skirmishes while firing full-size replica cannons. Information is available from The Brigade of the American Revolution, 5818 Fourth Ave., Brooklyn, N.Y. 11220, and from the North/South Skirmish Assn., Box 245A, Rt. 2, Winchester, Va. 22601.

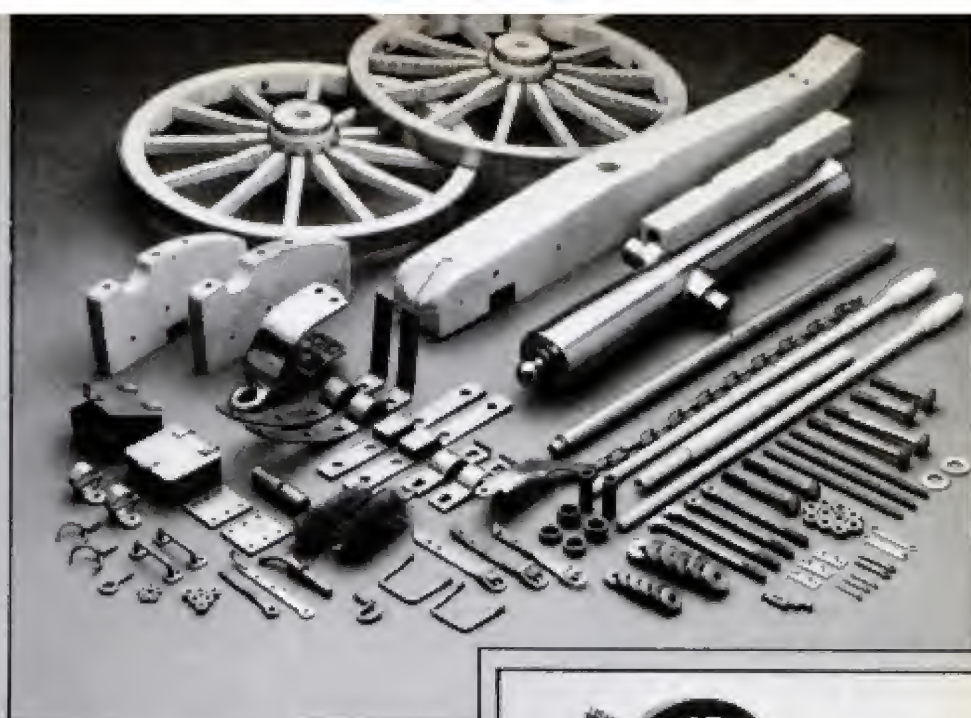
But more would-be cannoneers are finding they can get started on a smaller scale with excellent scaled-down "replicas" that duplicate the originals right down to firing a small charge of powder, or sit on shelves as handsome miniature reminders of our nation's past.

The latest mini-cannons are fun to assemble and reasonable in price. A full-size, 1250-pound tube for a Model 1857 Napoleon 12-pounder costs an impressive \$2460 from South Bend Replicas. Then you get to build the carriage and other equipment for it, and the overall expense can run up to several thousand dollars more. There is also the question of where to keep a six-foot cannon with a three-inch bore, and the problem of what the neighbors say if and when you touch off a few practice rounds.

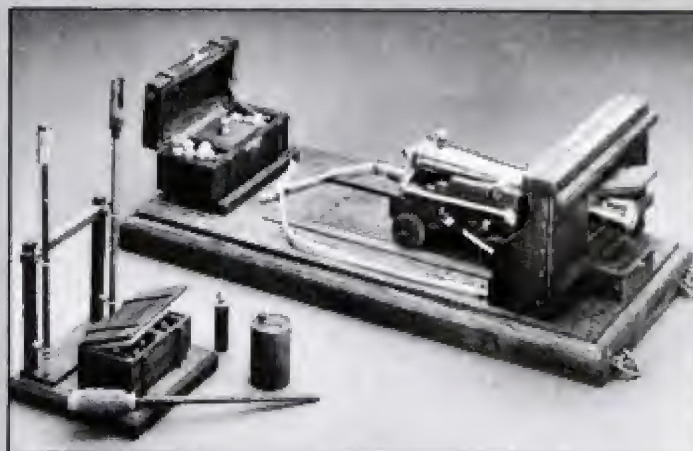
Scale down this same Napoleon, however, and it can become more practical in both size and price. From Connecticut Valley Arms (CVA), a one-fifth-scale Napoleon, as shown at left, is available in shootable or show-off kits with barrel and all parts to build the carriage for \$154.95, or completely assembled at \$209.95. It comes with instructions for assembly and loading—either with blank rounds or, for target practice, with .69-cal. lead balls, the same size fired by Revolutionary War muskets.

If tales of the famous ship *Old Ironsides* are your inspiration, a naval truck gun may be the answer. As a kit from CVA, the finely sanded wood and polished metal parts are \$27.95. For an additional \$6, the finished cannon is ready for firing. The bore size is the popular .44 cal., used in many of today's muzzleloading rifles and revolvers.

From a later period, CVA also has a newly introduced 7th Cavalry cannon. Built on a scale similar to the Napoleon, but modeled on a smaller original, it sells for \$135 as a kit or \$190 finished. It, too, has a rifled barrel and comes in .58 cal., the standard Civil War rifle caliber. Unlike many other kit cannons, these CVA models have polished barrels and



From these quality kit parts (above), worth \$155 from Connecticut Valley Arms (CVA), an authentic one-fifth scale Napoleon replica can be assembled into a showpiece (right). Prepolished barrel fires blank loads or the .69-cal. lead balls used in Revolutionary War muzzleloader muskets. Fully assembled, ready-to-fire model costs \$210—so there's a \$55 bonus for a do-it-yourself builder. An inexpensive start for many is to collect kit-company catalogs.



Because the enemy's cannonballs of 1812 rebounded from the *USS Constitution*, which then returned broadsides with cannons such as this, the Navy warship earned her *Old Ironsides* nickname. Truck gun was hauled forward in battery position, rolled back on recoil. Small CVA replica is \$28 as kit, \$6 more ready to shoot or show. It fires a .44-cal. ball.

well-sanded wooden parts ready for easy finishing and assembly. About all the craftsmanship involved is that of painting or wood finishing.

Another prime source for mini-artillery is the Dixie Gun Works. While Dixie can supply the CVA kits, they also have a number of special offerings of their own. Many of these, like their replica of a French 18th-century sundial saluting cannon, come as unassembled sand castings, leaving much of the finishing work for you to do.

The Sun Dial Alarm Cannon Kit, \$37 from Dixie, has the makings for a fascinating toy out of the past. The nine brass castings can be assembled in a few moments, but the time-consuming polishing is left up to

you. Dixie suggests careful filing followed by sanding with fine carborundum paper used like a shoeshine cloth. Time can be saved by using a vertical-belt sander-grinder, however. It removes the rough edges and sand-cast finish more quickly and neatly. By working from behind with a small piece of rounded wood to press the belt against the work, it's possible to smooth inside corners and hard-to-reach spots. Progressing to smoother belts and a polishing wheel, a gleaming result is achieved in about four hours.

To fire your cannon, situate it outside in the sun so that the bright spot through the burning glass is focused near the vent. Then remove the glass from its seat before pour-

Two serious problems: safe operation and sources of power

ing any powder. A pistol flask that throws a 22-grain charge of 3FG black powder for a .36-cal. percussion revolver is the easiest way to load. Pour the charge down the barrel and then sprinkle a short powder train in the groove leading to the vent. Blow away any spilled powder grains and put the loading flask away.

Now stand behind the piece with your shadow falling over the ring



Brass sand casting, imitation-marble base are parts for Dixie's \$37 Sun Cannon.

that holds the magnifying glass. Place the glass in the ring and step aside. The gun will fire off on the instant the focused sun spot hits the vent. The bang is impressive and the flash from the vent may be enough to blow the burning glass out of its ring. The metal around the muzzle is fairly thin, however, so do not attempt to fire a ball from the piece.

Assorted other models from Dixie range down from full- and half-scale Civil War muzzleloaders to a 6½-inch-long hand cannon copied from a Chinese original for \$11.50. Another source is the Moyer Brass Foundry, specializing in eighth- and quarter-scale models with cast carriages and wheels. Prices range up from \$4 for a three-inch Congress mortar barrel in bronze or \$7.50 with aluminum base as a rough-cast kit. Coehorn mortars with 4-inch barrels and bases list at \$22 finished. For \$3 more you can obtain a one-eighth-scale 1841 Field Cannon or, for \$750, jump up to half-size.

If extra-safe noise is your goal, try a carbide cannon. Starting at \$11, or \$26 for the version shown here, these old favorites mix carbide with water in the cannon to make explosive acetylene gas. Carbide can be bought locally or is available from carbide cannon sources in \$1 tubes labeled Bangsite. Projectiles cannot be used with these cannon and there is no smoke when firing, although it can be faked with a pinch of flour in the muzzle. Dixie Gun Works and Johnson Smith Co. are among the

sources for these carbide cannons.

Another old timer and a favorite with yacht club race committees is the Model 1898 Signal Cannon originally made by Winchester. Out of production for 40 years, this breech loader that fires a 10-gauge blank is now being made again by the Bellmar-Johnson Tool Co., and is also being handled by Navy Arms Co.

For real authenticity in both full-size and smaller scale cannons, South Bend Replicas Inc., is a prime source. Fans of muzzleloading artillery gladly spend \$4 for South Bend's Antique/Replica Ordnance catalog if they can't afford the finished products. A close second at \$3 is the Ashe Ordnance Works catalog of carriages and accoutrements for cannon. Need an authentic field carriage for a circa 1776 British six-pounder, or Captain Congreve's light cannon carriage circa 1778? Ashe has the specs and will build one for you, though this kind of craftsmanship can turn out to be very costly.

Yet in spite of their nostalgic appeal, muzzleloading cannons present two serious problems to would-be cannoners—safety of operation and sources of powder. In some ways the models are more dan-



Use a belt sander-grinder to smooth rough castings more quickly than by hand.

gerous than full-size cannons, because they offer the same opportunities for accidental discharge and more chance for you to be careless and lean in front of the muzzle. Here are basic rules:

■ Use only *black powder* in the recommended grade and quantity for your size cannon.

■ Wipe out the bore with a wet swab after each shot.

■ Wait a sufficient time between shots to be sure there are no lingering sparks in the bore.

■ Load only with premeasured charges prepared in aluminum-foil cartridges.

■ Use a safety ramrod shaped like a cane so that your hands never come in front of the muzzle.



Breech-loading, 10-gauge Winchester race-start cannon is now available again, from Bellmar-Johnson Tool Co.

■ Keep powder and cartridge containers closed and avoid spilled powder.

■ Wear eye protection against the touch-hole blast and ear protection against the noise.

■ Follow scrupulously the fusing recommendations for your specific cannon and keep far away from the explosion.

■ If you are inexperienced, be certain that you get help and supervision from an expert.

■ To obtain the proper and safe black powder, check with your local gun shops and/or the National Muzzle Loading Rifle Assn., Box 67, Friendship, Ind. 47021. **PM**

MANUFACTURERS' LIST

Sources for shooting and decorative cannons (both models and full-scale), plus plans, castings, carriages and catalogs, include:

Ashe Ordnance Works, Box 29, Glendale Springs, N.C. 28629;

Bellmar-Johnson Tool Co., 445 Putnam Ave., Hamden, Conn. 06517;

Connecticut Valley Arms (CVA), Saybrook Rd., Haddam, Conn. 06438;

Dixie Gun Works, Gunpowder Lane, Union City, Tenn. 38261;

Fox Ridge Miniatures, Box 619, Locust Valley, N.Y. 11560;

Francis Green, Box 892, Shalimar, Fla. 32579;

Johnson-Smith Co., Box C-10, Mount Clemens, Mich. 48043;

Live Steam Magazine, Box 581, Traverse City, Mich. 49684;

Moyer Brass Foundry, 190 West Davis St., Tiffin, Ohio 44883;

Navy Arms Co., 689 Bergen Blvd., Ridgefield, N.J. 07657;

Rhodes Ltd., 5246 Xerxes Ave. S., Minneapolis, Minn. 55410;

South Bend Replicas Inc., 61650 Oak Rd., South Bend, Ind. 46614.

2 great woodworking tricks

EASY WAY TO SCRIBE A LARGE CIRCLE

This easy-to-make compass lets you draw arcs that would be impossible with a conventional compass. It is constructed of two strips of wood hinged as shown with a nut and bolt. Each leg should be slightly longer than the distance from one end of the planned arc to the other.

1. To use the compass, put brads or nails where you want the arc's end points. Draw a straight line to connect them and mark the high point of the arc. Place bottom of the compass legs against the nails and adjust the compass until its apex is at the arc's high point. Tighten the bolt.

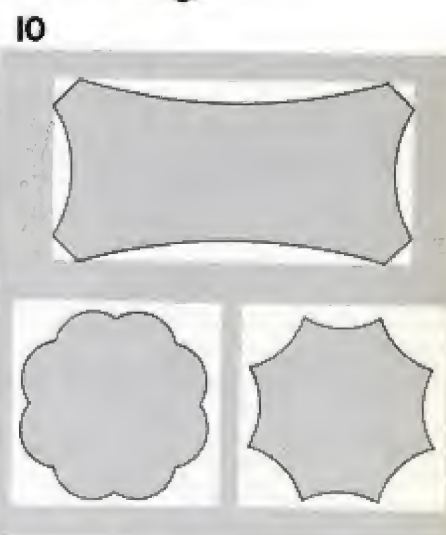
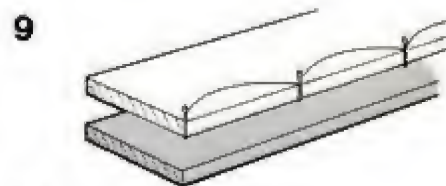
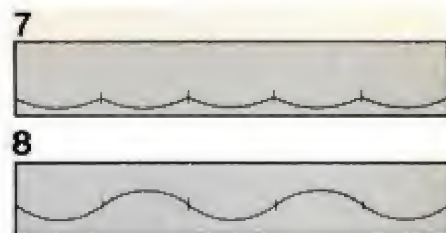
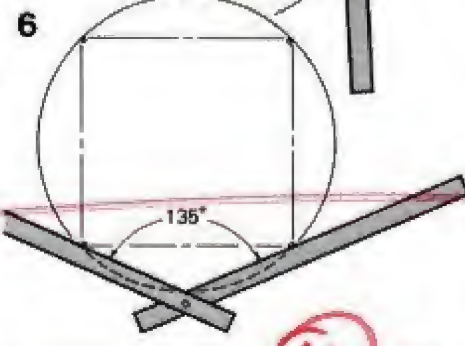
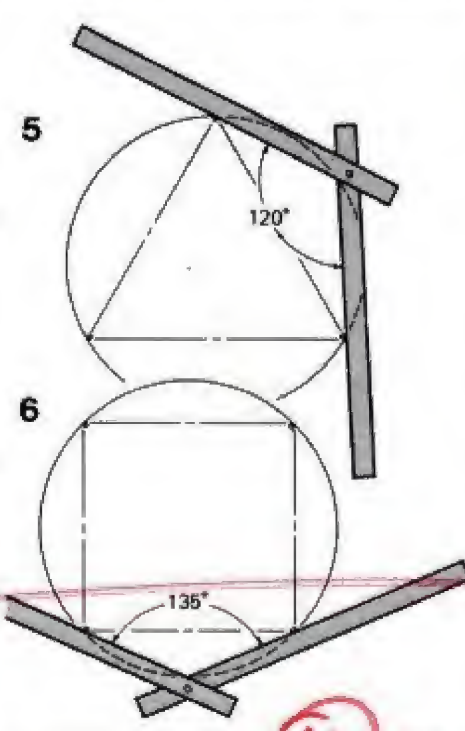
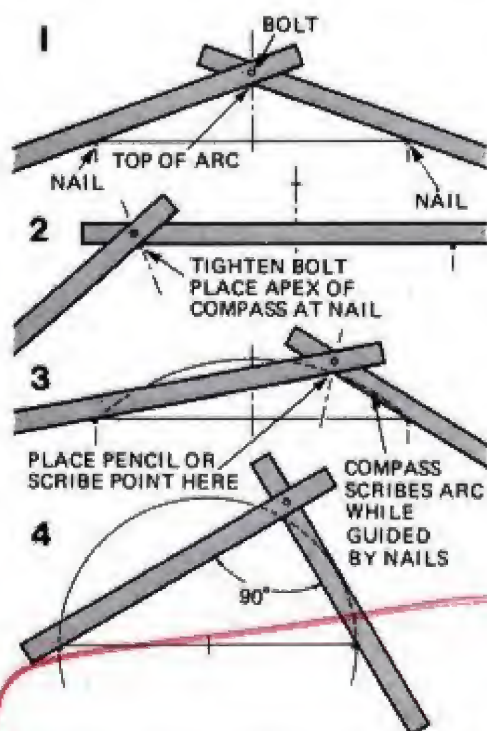
2. Place the apex at one of the nails.

3. Hold a pencil at the apex and move compass legs across the nails, maintaining contact at all times.

4. Compass legs can also be set at specific angles. Set at 90° , the compass will scribe perfect circles or semicircles.

5. By setting the compass at 120° and positioning the nails to make an equilateral triangle, it will scribe a complete circle if used on each pairing of nails successively.

6. Similarly, the compass set at 135° scribes a circle if four nails are positioned to form a square. The last two examples are useful when lay-



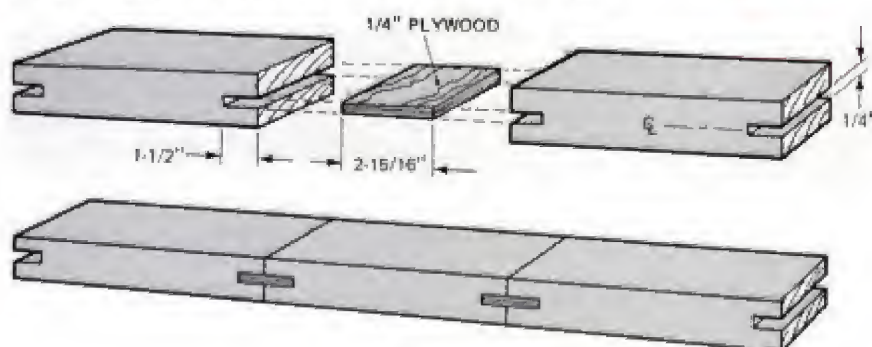
ing out a circle for a walk or driveway if an obstruction prevents the use of a center point. Using four nails (or stakes for large outdoor projects), as opposed to two or three, makes compass use easier since the compass legs can be made shorter.

7, 8. Other uses include the making of scalloped patterns and wavy lines. Be sure to place nails at equal intervals and in a straight line.

9. If the guide nails for a desired pattern need to be positioned on the workpiece edge, use a second board to hold the nails.

10. Decorative shapes can also be laid out.—*Bob Tom*

SPLINE TRICK LETS YOU USE UP SCRAP



Don't burn up 2- and 3-ft.-long 2x4 scrap wood in your fireplace. "Stretch" those pieces back into usable lengths by spline-joining them together. To do so, first square all ends. Then cut slots for the splines—a tenoning jig and dado head on a table saw work best for this. Do not attempt this operation without a jig. (See note below.) Next, join lengths with splines and glue. When dry, they can be used to frame nonbearing partitions.—*J. Edward Thornberg*

Note: For plans to build your own tenoning jig, see PM, page 146, July '71—or send 65 cents to Popular Mechanics, Dept. JP, Box 1014, Radio City Station, New York, N.Y. 10019 for photocopy reprint.

Sprayers to battle midsummer pests



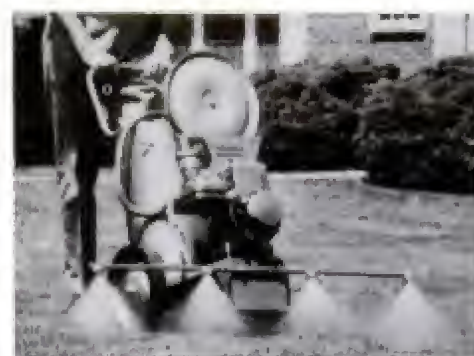
Get added use from a garden tractor with Marien sprayer, Model 105, and a 30-gal. plastic garbage container. Combination lets you treat trees and turf. About \$235.



Dobbins' power sprayer, Model 1072, is sized for suburban use, costs about \$320.



Larger units, like a Mighty Mac Model PS 350T, save time on large expanses of sod. It can treat a 10-ft.-wide area in one pass and sells for approximately \$570.



Hudson's 42025 sprayer, with 12½-gal. capacity, sprays a 5-ft.-wide swath per pass. It sells for about \$415, and comes with electric power or as a towable unit.

Here's how to keep insects from eating your garden produce before you do.

by Glenn S. Hensley

Overhead, underfoot and in the air around you, a myriad of midsummer plant pests are craftily conducting their own insidious brand of guerrilla warfare. Their mission in life is to eat your garden produce before you do and to mess up your well-groomed lawns and gardens.

Peashooter-type defense weapons

can't stop their attack any more than an air rifle can halt a determined terrorist. So what are your alternatives?

You could hire a professional landscape expert and let him rout the enemy. Or, you can fire up a power sprayer and become an instant hero yourself.

One of today's lawnmower-size sprayer units, either gasoline or electrically powered, can be a mighty useful power tool. Around the house you can use it for all your yard and garden spraying jobs—

trees, ornamentals, lawns, flowers, vegetables. You can also use it to control mosquitoes and flies, disinfect areas, wash surfaces and serve as a standby fire extinguisher. If you have a picket fence, you can even apply whitewash or water-based paints with it. In fact, you'll find ways to use it in some manner throughout much of the year.

Such sprayers are available either with their own wheels and push-type handlebars or equipped for towing behind a garden tractor. They range from about \$250 to over \$1000, depending on capacity of tank, size of engine, type of pump and the variety of nozzles you choose.

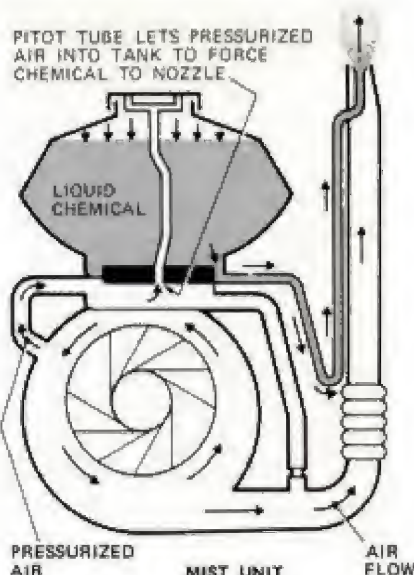
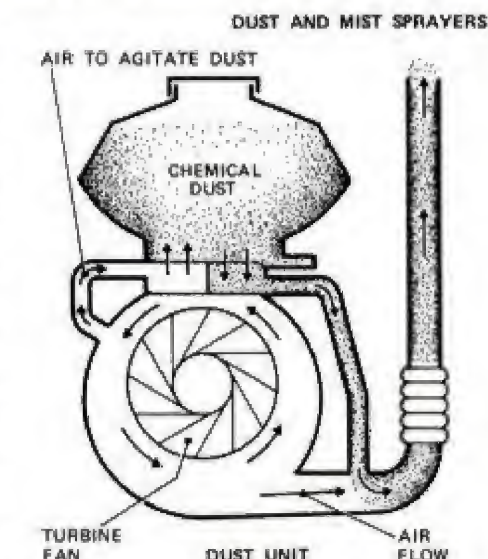
The author is the editor of *Farm and Power Equipment*, a publication serving farm and power equipment dealers.

Blowers can blast yard and garden invaders

Backpack-style mist and dust blowers are other weapons you might want to have for plant protection and pest control. Powered by two-cycle gasoline engines, these little weed and insect fighters weigh less than 25 lbs. Depending on the options you select (dust hoppers, twin chemical tanks, granulate attachments or even flame throwers), you will pay from \$325 to more than \$500 for a quality blower.

Blower-type applicators are easy to use. With one hand, you can direct a jet of solution against the "enemy" more than 30 ft. up in the air (about 25 ft. horizontally), or you can blanket the area with a chemical fog. It all depends on how you direct the air blast and the kind of nozzle you're using. In addition, you can evenly distribute pest control dust with some makes—Solo's Models 410 and 423, for example.

Usual recommendations call for chemical concentrations in mist blowers



Optional accessories let you convert some compact blower-type sprayers into dusters, as well. Several units will even serve as fertilizer and seed spreaders.

to be 10 times that used in a conventional yard sprayer. For instance, 1 gal. of solution in a backpack sprayer will cover the same area as will 10 gal. in a push- or pull-type power sprayer. Be cautious with your chemical mixing to prevent overdosing of plants. It's good to begin operations with concentrations of only five times as much chemical as is recommended for conventional use.

If, for instance, dilute mixing instructions for a conventional sprayer call for 1 tablespoon of chemical for each gallon of water or oil, use 5 tablespoons to the gallon in a mist blower. As you gain experience, you can increase the concentration to 10 tablespoons per gallon. Under all circumstances, though, follow mixing directions religiously. When spraying, never saturate foliage to the point where spray drips to the ground.

When using an extremely fine mist spray or when fogging, note that small droplets can be carried far by air movement. Not only will you waste chemicals, but you may damage plants, wildlife—even people—outside your planned treatment area. Observe the manufacturer's safety recommendations.—G.H.



Stihl's Model SG17, selling for about \$300, has a 33-ft. upward spray range. It also converts to a duster and can be used for spreading granular material. Its two-cycle engine can be started with unit on your back—a handy feature.



Compact mist blowers, such as Vander-molen's KWH Model 44MP (about \$400), feed chemical by gravity from top tank into blowpipe nozzle for best results.

What to look for

When purchasing such a sprayer, remember that the size of the tank does not reflect the quality or usefulness of a particular model. It is important, however, to select a unit with a rust-resistant tank. Many of the chemicals you'll be spraying are both corrosive and toxic—and rust can clog the unit, thus shortening the life of your machine.

Agitation of spray chemical materials in the tank is also quite important. This is usually accomplished

by the motion of the solution sloshing around and is known as hydraulic agitation. Many chemicals, however, do not mix readily with water and can only be kept in suspension by mechanical agitation. This may be standard on the machine you select or can be supplied as an option, for which you will pay extra.

Types of pumps

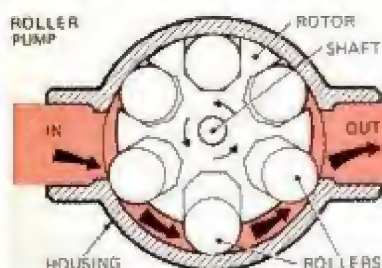
The heart of any sprayer is its pump. The three most commonly used types on lawn and garden pow-

er sprayers are roller (nylon or rubber), centrifugal and piston pumps. Each has its advantages and disadvantages.

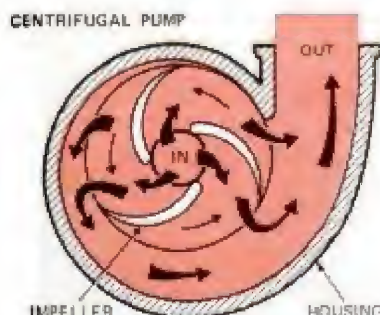
Nylon roller pumps are often used because of their low cost and adaptability to a wide range of applications. For longest life, avoid wettable powders and keep pressures down to around 35 to 65 lbs.

Piston pumps are excellent since they can be made to provide high pressure, up to as much as 500 lbs. per square inch. They are available

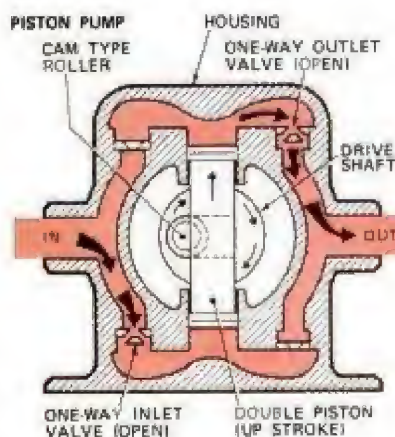
How pumps operate



As the off-center rotor turns in a roller-type pump, the nylon rollers are forced against the side of the housing by means of centrifugal force. Liquid is pulled into the housing as the gap between the rotor and housing is widened. Then the liquid is forced out through the discharge port as the gap becomes narrower. Arrows show the typical flow pattern of the liquid.



In a centrifugal pump, a sealed shaft transfers power to impeller from the engine or motor. Liquid is drawn into housing by vacuum from the opening behind impeller. Pressure from rotating impeller forces liquid out the discharge port.



In a piston pump, the driveshaft is fitted with an off-center roller. During pump operation, the camlike motion of the roller activates the double piston. As the piston moves up and down, the liquid is forced alternately from the upper, then the lower, pump chamber. One-way inlet and outlet valves are pressure-activated. For instance, when the liquid is being forced from the upper chamber, as shown above, pressure closes the top inlet valve. Simultaneously, the vacuum that is formed in the lower chamber closes the lower outlet, while drawing open the lower inlet.

in low- to high-volume output, withstand abrasion extremely well and are easy to repair when worn. Naturally, they are more expensive. A pulsation dampener, available as standard equipment or as an option, smooths the output flow of spray solution.

Centrifugal pumps are real workhorses for volume, but they will not

supply high pressures without an excessive dropoff in that volume. They have good wear resistance, replacement parts are inexpensive and owner service is simple.

If you expect to expand your garden, orchard or lawn, choose a sprayer that will meet your future capacity needs and ask about the availability of attachments you might need later.

No matter what make of sprayer you select, it can do no better job than you will let it do. Study the owner's manual to learn proper calibration of the spray, how to maintain the unit and how to clean up after use.

Selection of proper pest control chemicals is as important as learning to operate your sprayer. Advice and guidance can be obtained from your state university's extension division, free or at minimal cost. Finally, read and obey all label information on chemicals you are using. Take all precautions. Better safe than sorry.

PM

MANUFACTURERS' LIST

Amerind-Mackissic Inc., Box 111, Parker Ford, Pa. 19457; Mighty Mac.
The Broyhill Co., North Market St., Dakota City, Neb. 68731.
The Firco Manufacturing Co., 1st and Court Sts., Sioux City, Iowa 51101; Dobbins power sprayers.
G.M. Grabow Inc., 14 Virginia Ct., Ridgefield, Conn. 06077; Marlen sprayers.
H.D. Hudson Manufacturing Co., 500 North Michigan Ave., Chicago, Ill. 60611.
Solo Motors, Box 5030, Newport News, Va. 23606.
Stihl Inc., Box 5514, Virginia Beach, Va. 23455.
Vandermolen Corp., 119 Dorsa Ave., Livingston, N.J. 07039; Driftmaster.

Save fuel, get exercise with a you-power-it unit

If you want some easy exercise while treating your lawn, then look at Driftmaster's Model P 18. Available for about \$70, it's designed to work like an oversize paint roller and will apply selective weed killers or liquid fertilizers at no risk of chemical drift onto adjacent areas. Roller width on the P 18 is 18 in. Other models provide coverage of 27 and 36 in. A 6-gal. tankful on the largest model will cover 400 to 600 sq. yds.

A Broyhill 2200-series sprayer will also give you an excuse for skipping your jogging duties for a day. Its wheel-



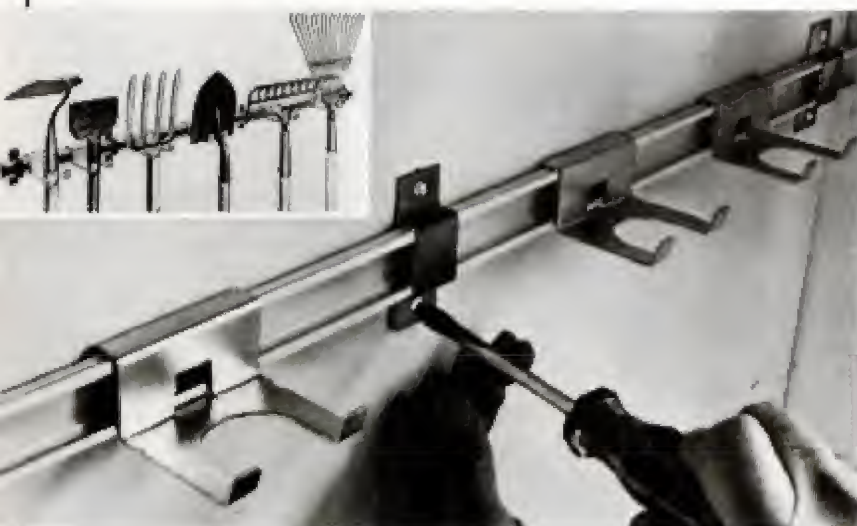
Driftmaster M36, designed to keep solution droplets from drifting in air, is \$245.



Broyhill's 2200-H holds 5 gal. of solution in a corrosion-resistant container, rolls easily on 10-in.-dia. wheels.

mounted pumps, driven by friction contact with the ground, disperse chemicals through nozzles as you push the sprayer along. A 3-ft. spray width is standard, but an optional attachment will increase the coverage to 5 ft. It retails for about \$130.

NEW NOW for home and shop



A A neat way to organize garden or shop tools is provided by the Hang-A-Tool rack. Unlike some perforated-board hanger hardware, this rigid metal rack won't loosen every time you reach for a tool. The track is 50 in. long, comes with six steel hangers and four mounting brackets. Hangers slide on track for flexibility. About \$5 at hardware stores. Marathon Carey-McFall Co., Montoursville, Pa. 17754.

B With the boom in racquet sports has come a rise in serious eye injuries. Solari eye guards are designed to provide maximum eye protection with a minimum of visual interference; vertical split bars replace glass or plastic lenses. The poly-carbonate guards are lightweight, fit all sizes and cost \$11 to \$15 at sporting goods stores. Solari Manufacturing Inc., 1670 Cordova St., Los Angeles, Calif. 90007.

C Dustbuster is a cordless vacuum cleaner for small cleanup jobs around house, shop or car. Weighing 1.6 lbs., it has no power cord or suction hose and recharges continuously in its storage base. Permanent filter bag is washable. Unit is said to pick up as much as 9 lbs. of sawdust or 16 lbs. of potting soil on single charge. Retail for about \$30 at department stores. Black & Decker Manufacturing Co., Towson, Md. 21204.

D Desert Sage is the latest pattern in Armstrong's Excelon tile line. The 12x12-in.-square tiles are designed for do-it-yourself installation and come both with and without adhesive backing. To install, protective paper is removed and tile is placed in position and pressed down. Place 'n Press tile is about 55 cents per tile; Excelon tile (without backing) is about 35 cents. Armstrong Cork Co., Lancaster, Pa. 17604.

A



C



D



How to raise and level stepping stones



1 Use pointed trowel to trim back overgrown grass and expose stone. Save sod for finishing after stones are raised.



2 Use back of shovel to force sod away from edge of stone. Expose all edges so that stone can be raised easily.



3 Tip stone on edge and pour in sand needed to raise it to the proper grade. Level sand, reposition the stone.



4 Use straightedge to check elevation and slope of raised stones. Tops of stones should conform to grade of lawn.

Restore sunken walkways by raising your stepping stones to their original height. Cast-in-place stones settle in the ground over the years and often become overgrown with grass. Rain puddles may form atop sunken stones, making them slippery and dangerous. The only material you need to bring stones up to grade is mason's sand. For tools, you need a round-pointed shovel, a carpenter's level, a 6-ft. straightedge (a 1x4 will do), a 4-ft. length of 2x4 for tamping, and a small, pointed trowel.

Plan to do the work after it rains, when the ground is easily worked. The best approach is to raise every third stone and then bring the intermediate stones up to grade, using your straightedge between those previously set. Use the trowel to trim overgrown grass as shown and expose the outline of the stone. Then use the shovel as a lever to force sod away from the stone's edges. Push sod back until the stone's bottom edge is exposed before trying to raise the stone.

Use a straightedge and a carpenter's level to help judge how much sand you'll need. The top of the stone should be about 1 in. above ground level. Pry up one side and stand stone on edge (there's no need to lift and remove it). Hold stone with one hand, then pour and spread sand with the other. Lay stone back in position.



5 Tamp sod back into place around raised stones. Finished job provides dry walkway and restores outline of stones.

Check again with straightedge and level. Repeat process, adding or removing sand as needed to attain proper level. Be sure to stand on the stone and check for "rocking" before you press the sod back around the edges. Tamp sod with the 2x4. Clean dirt off newly exposed edges of stones with trowel.—James McMahon.



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Build a

PM photos: Robert Whittington



PM's heavy oak table can be used in dining room or kitchen to seat four comfortably as above. View from below (far left) shows details for pedestal and extension slides. Add one leaf and six can dine with ease; both leaves are used to seat eight. Notice the pins in edge of the extension leaf (near left). These make it impossible to install a leaf incorrectly. Increasing table capacity is a one-person job.

classic oaken table

This sturdy table is in a style that was popular at the turn of the century.

by C.E. Banister

There's something reassuring about eating at a sturdy oak table that you know will be around awhile. PM's prototype, crafted from substantial red oak, should last a few lifetimes. The design is at home with almost any decor—traditional or contemporary—and it's functional. It can gracefully accommodate a boisterous holiday party or a quiet candlelit tête-à-tête, along with every meal in between.

Taken one step at a time, the table construction is easier than you would think. We give you all the details for making a circle-cutting jig,

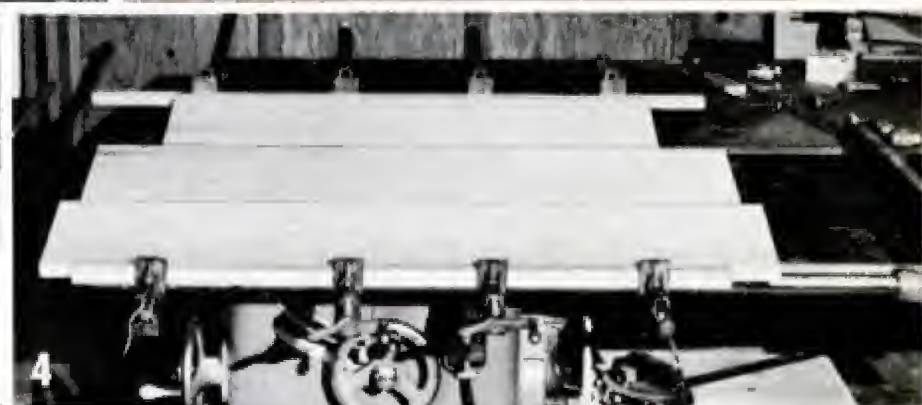
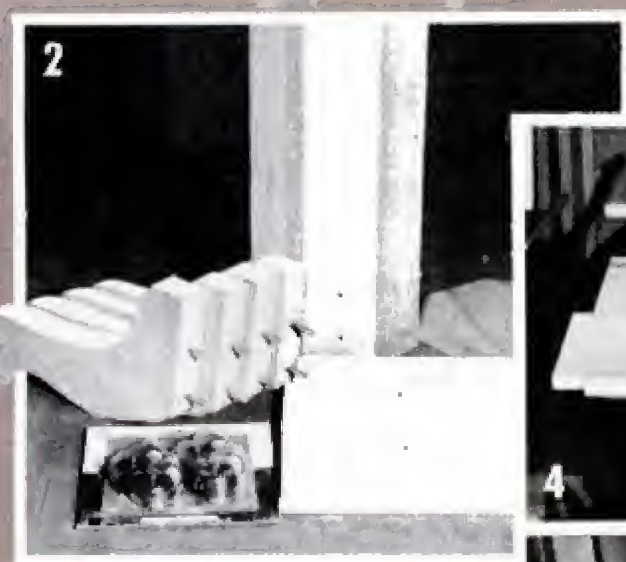
which not only simplifies cutting the tabletop and round apron in this project, but will come in handy for circle-cutting tasks in the future.

After gathering all materials (see source for specialty hardware in the materials list on page 84), lay out and cut eight pedestal segments (A) with a table saw. Spline grooves can be cut with a saw blade having a $\frac{1}{8}$ -in. set. Use $\frac{1}{8}$ -in. hardwood plywood to make strong splines (J). Run through the assembly dry before gluing and clamping the joints. Belt clamps are ideal, but if you have none, loop ropes

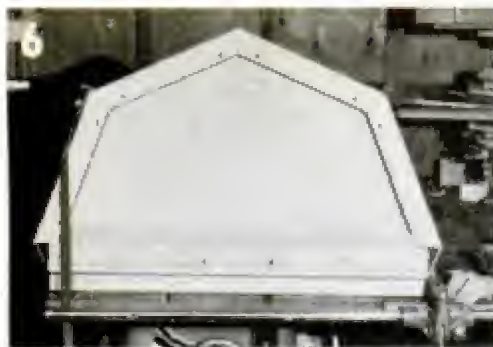
around the pedestal, then twist and secure them to serve as clamps.

Next, make a pattern for the table feet (G), using the grid in the plans. Trace the shape onto the glued-up oak stock and make the cuts with a bandsaw or heavy-duty sabre saw. Bore holes in the feet as directed by the caster manufacturer. Also bore corresponding pairs of holes in the feet tops and pedestal to accommodate the hanger bolts, which serve to join the two together.

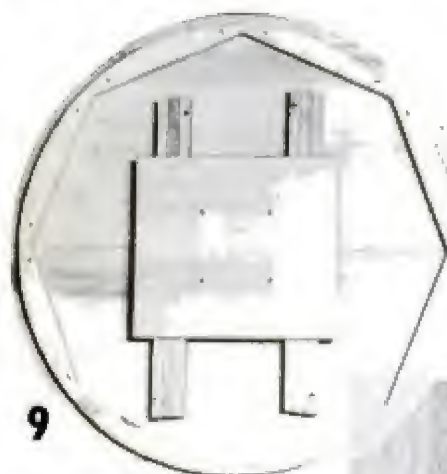
Install the feet and complete the oak table



1. Glued-up stock for table feet helps to economize on expensive hardwood. 2. Hanger bolts turned into feet will be fastened to pedestal with nuts and washers. Stem-type casters make this heavy table easy to move. 3. Splines reinforce pedestal's cooper joinery and insure a sturdy table support. 4 and 5. Glued and clamped stock for tabletop is cut round, using the jig which is detailed in the plans shown on page 95.



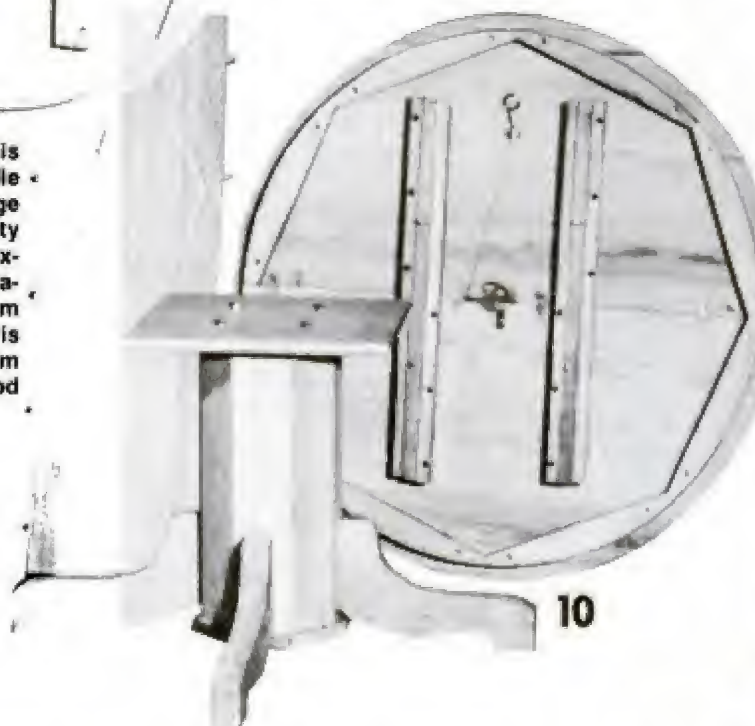
6. Apron segments are splined, glued together and nailed to jig surface, CC.



9. Slide support (H) is fastened to middle member with carriage bolts. 10. Specialty hardware, such as extension slides and table lock mechanism with cable pull, is available by mail from the Craftsman Wood Service Co.



7. With apron assembly on sliding jig base, straight cuts form half circle. 8. Sliding jig base can cut many sizes.



support by making the octagonal base cap (B) and the top cap or slide support (E). Shape the detail around the base cap sides with a $\frac{3}{8}$ -in. rounding-over bit and use screws to fasten it to the column base. Use hanger bolts to fasten the slide support to the column top.

Carriage bolts can be used to attach the extension slides (L) to the slide support (H). Be sure to counter-bore, so that bolt heads don't interfere with spreading and closing tabletop halves.

Making tabletop sections

All that remains is to make the tabletop sections and apron. Edge-join the boards (D) for the table halves.

Alternate the end-grain directions to help minimize warping, and strengthen the edge joints with dowels. After the boards have been glued and clamped, make the circle-cutting jig shown in the plans. For a simpler, nonadjustable version, use a nail as a fixed pivot pin. Locate the nail/pivot on the sliding-jig base 21 in. from the table-saw blade for cutting the semicircular aprons.

Now, secure the workpiece to the jig, using screws or nails driven up through part CC. (Do not install fasteners in line of cut.) Position the sliding jig base in the miter groove and align pivot pin on sliding base with hole in jig part CC. Adjust the blade height to $\frac{1}{8}$ in. above the

MATERIALS LIST—OAK TABLE

Key	Pcs.	Size and description
A	8	$\frac{1}{2}$ x 3 x 20" red oak
B	1	$\frac{1}{2}$ x 11 x 11" red oak
C	2	$\frac{1}{2}$ x 11 x 42" red oak
D	6	$\frac{1}{2}$ x 7 x 42" (max.) red oak
E	4	$\frac{1}{2}$ x 2 x 11 x 1" red oak
F	8	2 x 2 x 16 x 1" red oak
G	4	2 x 9 x 14" (may be glued-up) red oak
H	1	$\frac{3}{4}$ x 16 x 18" plywood
I	6	$\frac{1}{2}$ x 2 x 2 x 1" red oak
J	8	$\frac{1}{2}$ x 1 x 20" hardwood plywood
K	24	$\frac{3}{4}$ -dia. x 2" birch dowels
L	1	28" long (closed) extension slide set*
M	6	16-ga. x $\frac{3}{4}$ x 2 x 1" steel
N	16	birch table pins*
O	1	table lock*
P	4	2"-dia. casters
Q	8	$\frac{1}{2}$ -dia. x 3" hanger bolt*, nut, washer nut
R	4	$\frac{1}{2}$ -dia. x 3" carriage bolt, washer
S	4	No. 12 x 2" fh screws
T	24	No. 12 x 2 x 1" fh screws
U	8	No. 12 x 2 x 1" fh screws

MATERIALS LIST—CIRCLE-CUTTING JIG

Key	Pcs.	Size and description
V	14	No. 8 x $\frac{1}{2}$ in. screws
W	2	$\frac{1}{2}$ x $\frac{3}{4}$ x 24" tempered hardboard
X	1	$\frac{1}{2}$ x 12" chest slide support, or cut 16-gauge steel bar to suit
Y	1	$\frac{1}{4}$ " length cut from nail
Z	1	$\frac{3}{4}$ x $\frac{1}{2}$ " stovebolt and teenut
AA	1	$\frac{3}{4}$ x 20 x 24" plywood
BB	1	$\frac{1}{2}$ x $\frac{3}{4}$ x 22" hardwood miter bar
CC	1	$\frac{1}{2}$ x 24 x 42" plywood
DD	1	$\frac{3}{4}$ x 3 x 42" plywood
EE	1	2 x 2 x 40" (trim to fit)
FF	12	No. 6 x 1" fh screws

Misc.: White glue, $\frac{1}{4}$ " brads to suit

*These items can be ordered from Craftsman Wood Service Co., 2727 South Mary St., Chicago, Ill. 60608.

workpiece top surface and turn on the saw. Make straight cuts, removing a small amount of waste on each pass. Rotate the workpiece before—not during—each pass. Eventually you get a perfect half circle. Clean up rough spots with a belt sander.

Building apron assemblies

To make apron assemblies for the half-circle tops, assemble sections (F) on jig part CC to facilitate gluing and clamping. Once again, you can use band clamps, or rope twisted and secured to provide pressure. Use of spreader (EE), along with jig stop (DD), keeps assembly from collapsing while you set clamps or rope.

After the apron sections are glued, fasten them to the jig with nails from the underside of part CC. Cut to round using same procedure explained above.

Before the final assembly, make the table leaves with aprons to match those on the half-circle tabletops. Lay out and bore holes for $\frac{3}{8}$ -in.-dia. table pins and corresponding holes for the pins. Then install the tabletop lock and metal clips that keep the tops flush.

Apply stain of your choice following instructions on the can. Let dry 24 hours and apply paste wood filler (to fill the open pores). If necessary, tint filler with the stain. Let filler dry until shine disappears; then rub off with a coarse cloth (burlap). When dry, seal with a coat of thinned shellac and finish with a semigloss varnish.

**Most
shade-tree mechanics
begin here.**



STEWART-WARNER

The three platforms fit into any opening on the climber and serve as benches, steps, walkways, counters, desks or roofs.

PM's LADDER CLIMBER

(Continued from page 81)

clamps or rope for sufficient pressure to clamp the dowels. Now you can hinge the sides together.

Saddle (B) at the base of the doorway adds strength to the unit. Cut it and chamfer its top edges. Note notches in leg bottoms to receive the saddle. Fasten saddle in place with glue and screws.

The three platforms fit into any opening in the climber. In the lower positions they serve as benches or steps. In the middle positions they're used as counters, desks or walkways. Placed on top of the climber, the platforms can serve as the roof.

Cut slats (D) to size and carefully round and sand all edges smooth to eliminate splinters. Three slats fasten together with two cleats (E) to make a platform.

Cut and sand the cleats. Mark and bore screw pilot holes, countersink and attach cleats with screws.

After assembling the platforms, notch them at corners to fit snugly in place. You will need to cut away the excess in several steps and test-fit between cuts.

Once the kids get the hang of moving the platforms, you'll be amazed at the transformations this climber will undergo and the variety of play it will inspire.

PM



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**SPORTS &
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GET THE JUMP

(Continued from page 78)

clutch and throttle are all automatic. You should not have to think about how the controls work or where they are. You must be able to concentrate on traffic around you and operate the controls without fumbling for them.

Use a helmet, by all means. A sun visor is a must, too, as is a full-face shield to protect your eyes from the dust and dirt kicked up by traffic ahead, not to mention the birds and bees that can get to you in the country. A face shield really is a must even if you wear glasses, because at any kind of speed at all, dust gets behind glasses. Most states require eye protection, though some do not require helmets. In states where motorcyclists are not required to wear helmets, or where such legislation has been repealed, motorcycle fatality rates are well above those of states in which helmets are mandatory.

Racks and fairings

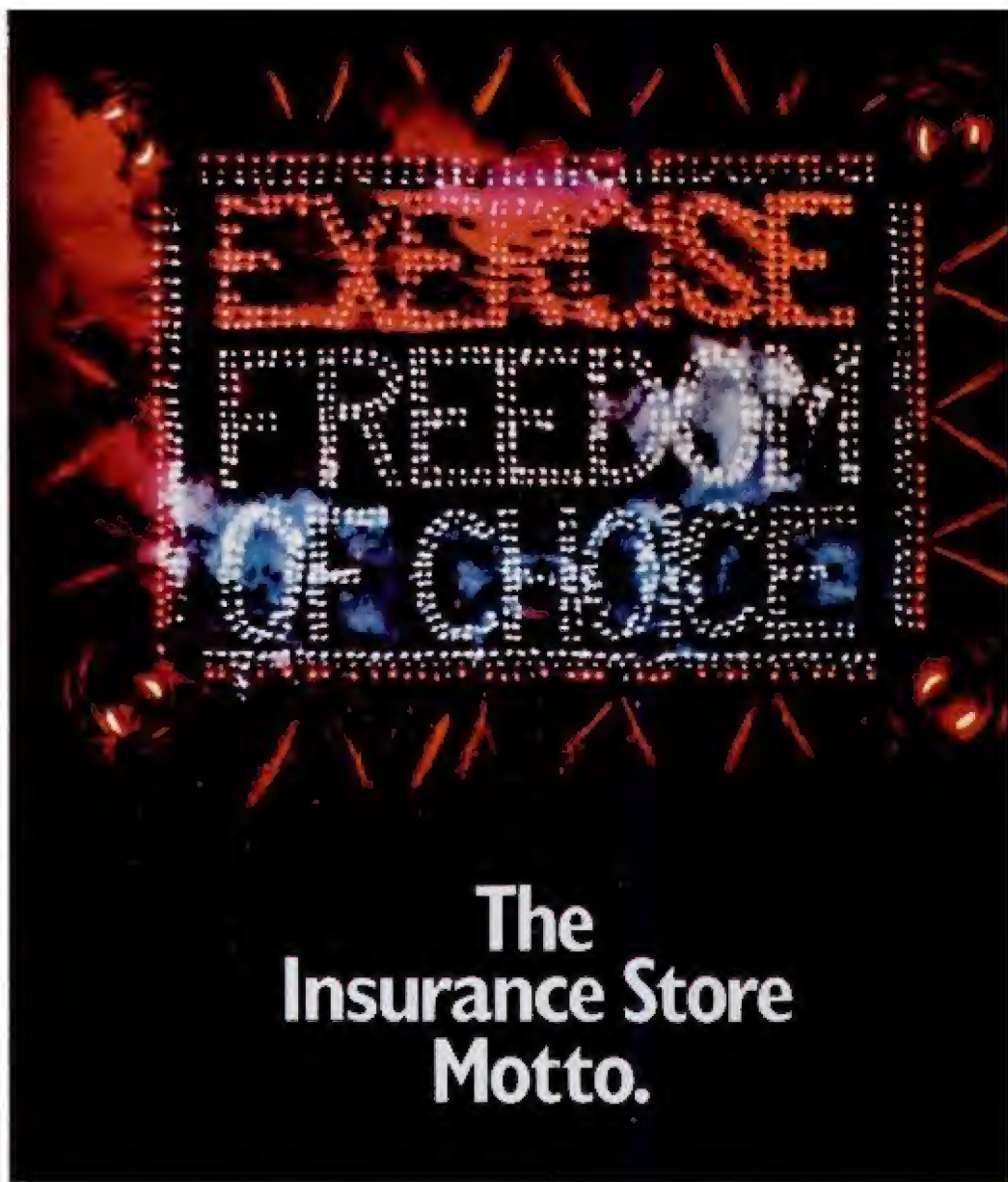
A small motorcycle can be fitted with a luggage rack to which you can attach a modest-sized plastic case (called a scoot boot) and side carriers (called panniers). The scoot boot and panniers on a 100-cc bike will carry a briefcase and approximately 12 books, to give you an example. If you tie things on your bike, be sure to use rubber tie-downs (bungee cords) or nylon line. You don't want anything wrapping itself around the rear wheel at 50 miles per. A good place to find saddle bags and luggage racks for small motorcycles is a moped dealer's store. You can buy wire baskets instead of side panniers, but they are wide and look a bit old-fashioned, even if wire baskets can carry a lot more groceries than panniers.

Fairings are plastic, handlebar-mounted windshields. A fairing is a major contributor to comfort because it blocks the wind. From 50° F. down, the wind-chill factor really builds up; a fairing can keep the wind from your upper torso. For your lower torso, plastic leg shields are effective. For your hands, you can get good wind protection with hand-guard attachments.

If your small motorcycle does not come with a right-hand mirror, install one. A left-hand mirror should already be there because it is required by law. A word of caution: Some mirrors are wide-angle. They let you see more of the road, but make cars look a lot smaller. So cars may be closer to you than you think. A normal right-hand mirror will let you judge more accurately the size of the car behind you; that is how close it is to you. A quick look over your shoulder will also help you in assessing the upcoming traffic.

Now that your small motorcycle is set up the way you want it, you can go out, crank on the throttle and enjoy going where mopeds fear to tread!

FM



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ULTRASOUND—MEDICAL MARVEL

(Continued from page 55)

tricky diagnoses. For example, a real time scanner can look *behind* the eyeball. "X-rays are worthless because the eye is not made of metal or bone. With ultrasound, we can look at parts of the eye that are as small as 12 thousandths of an inch thick," says Bard.

Ultrasound has enormous advantages over current diagnostic techniques. It's painless; a patient need only take off his shirt, lie down, let a nurse rub some gel on his skin, relax and watch the "Body Show" on TV. Equipment costs one-tenth as much as advanced radiation scanners.

In eye cataract surgery, ultrasound aspiration is easier than other surgery, requires smaller incisions, is less painful, and lets a pa-



Ultrasonic devices can also treat such things as tennis elbow (above), sometimes entirely eliminating the need for surgery.

tient leave the hospital the next day. Of course, ultrasound isn't the answer to every medical problem. It's not very useful for scanning head problems. It doesn't "see" well through bone. It's also weakened by air or bowel gas, so it's not useful for looking at lungs or intestines.

Experts say its most serious limitation is its complexity. It's the hardest scanning procedure to learn. Today, most doctors find that studying ultrasound scans is like being told to read an infrared map of a jungle without a key but with a life depending on it.

Ultrasonography has so far shown no harmful effects when used in low frequency for diagnostic purposes. Yet sound at extremely high frequencies can "burn" or dissolve tissue. The federal Food and Drug Administration has ultrasound equipment makers test a new system for years before it can be marketed.

Research into ultrasound's medical use began after World War II. Using surplus military radar and sonar equipment, physicians first used ultrasound to detect large cancer tumors in the stomach. Yet, it

was in two different fields—dentistry and physical therapy—that ultrasound first gained widespread acceptance. In the late 1950s, Cavitron of Long Island City, N.Y., developed an ultrasound device that painlessly breaks up dental plaque.

Rehabilitation medicine specialist Willabad Nagler of the New York Hospital-Cornell Medical Center says, "We've used sound with frequencies above 20 kHz to treat tendonitis for many years. The sound waves vibrate muscle tissue. The tissue gets warm, and the deep heating effect reduces inflammation in the joints. The joints and muscles loosen up."

But the boom in ultrasound began in 1974 with the first commercial "gray scale" scanner. Dr. Bard says that before "gray scale," there were two limited generations of scanners. The first had only two scales—black and white; the second introduced a third scale—one shade of gray. Obviously, only the most highly trained researchers could "read" or understand what they saw on the screen. Remember, too, that before real time scanning, every ultrasound picture was a still photograph. It showed only what existed when the "picture" was taken.

"The gray scale lets us take pictures in 10 shades of gray," Dr. Bard says. Thus, doctors could see the incredible detail given by six times more shading.

Color scanning coming

Real time scanning, introduced on the market in 1978, includes gray-scale scanning for "live-action movies" in black and white. Within several years, however, ultrasound scanning will become "live and in color." While it won't show actual body colors, it will have color-coded gradations from white and brown to red, blue and green.

The hardware for the machines consists of three main parts: a transducer (transmitter/receiver); a cathode-ray tube monitor; and an electronic phased-linear array. The array interprets the echoes through microprocessors and integrated circuits and generates the image and, in some machines, paper tape and digital readouts. Most machines, like a Toshiba Medical Systems SLA-10A Scanner, have recording cameras with Polaroid or 35-mm film capability, video tape or disc recording, TV hookups and more.

Toshiba makes three real time scanning models which are fairly typical. The most sophisticated Toshiba scanner has these features: four display modes; the ability to "see" up to 20 centimeters (about 8

inches) into the body; 2.4 MHz frequency; a 20-character digital display; four channels to monitor aspects of heartbeat; 15 to 30 frames shown per second on the monitor; the ability to see objects as small as 1 mm; and gray scale calibration. This machine is primarily used to watch, measure and diagnose the inner workings of the heart.

Besides color-coded images, expected advances in diagnostic hardware include transducer improvements. Dr. Bard says that an improved transducer is the key to making higher frequencies see deeper into the body. The lower the frequency, the deeper you can see, but the fuzzier the images become.

'Needles' in human haystacks

For example, Toshiba sees 20 centimeters deep with a resolution of between 1.0 and 1.5 mm. That means a doctor can see a spot or detail less than four one-thousandths of an inch (.004) long. In many cases, ultrasonographers can now find "needles" once hidden in the human haystack before they become serious health problems.

And companies like Cavitron are making ultrasound equipment safe and effective as surgical tools, too. David Wuchinich, a product engineer, says the new, advanced Cavitron Ultrasonic Surgical Aspirator (CUSA) is now being used by four neurosurgeons. "We had to develop an entirely new machine because brain tumor tissue and muscle are so much more resilient than eye tissue. We had to find a way to evacuate brain tumor material within its own space to minimize damage to nearby tissue," Wuchinich says.

The CUSA works at 23 kHz. The tiny, pointed surgical tool rapidly vibrates within an amplitude of .008 to .012 inches. A coaxial vacuum system loosens and aspirates tissue.

In many complex areas, doctors are combining ultrasound and nuclear isotope scanning with computer tracking techniques. A doctor at the University of Wisconsin uses ultrasound to improve the aim of electron-beam radiotherapy, protecting arteries from radiation exposure during heart surgery.

Expectant mothers all over the country are beginning to be able to watch an unborn baby's heart beating and legs kicking, says Dr. Peter Hydrick, an Atlanta, Ga., obstetrician. Hydrick concludes, "Are ultrasonics harmful? Not to my knowledge. It's the most reassuring thing we can do to let expectant mothers actually watch their babies' hearts beat inside their own bodies. The patients love it."

PM

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10 YEARS BEYOND THE MOON

(Continued from page 50)

a half to reach the superplanet. NASA engineers had fine-tuned the trajectory during the flight, so that the big robot would thread its way precisely through the moons to insure close looks at three of them and more distant shots of two more. One of the prime objectives of the mission was to sweep within a few thousand miles of Io, the innermost of the big four Jovian satellites.

Io got its name from an unfortunate mythological maiden who was turned into a heifer after an affair with Zeus, supreme god of ancient Greece. Voyager proved the name to be apt; Like the maiden, moon Io is undergoing some bizarre changes.

Something odd on Io

The first inkling that something was odd on Io came across space two days before Voyager 1 encountered Jupiter. Scientists saw large dark spots on Io. At first, they assumed they were impact craters like those sharply etched on our moon. But as each new photo appeared, the quilt of colors on the surface looked more and more strange. Resolution increased. Still, no craters appeared.

Then NASA scientists Linda Morabito and Steve Synnott made a key discovery. As often happens in science, they weren't looking for what they found. The two were using a computer to enhance a photo of Io to bring up faint pinpoints of light from stars; the technique enables them to locate the spacecraft precisely. As the computer brightened the photo, Morabito noticed an umbrella-shaped plume that had risen from Io's surface.

It looked familiar. She knew immediately that it might be an eruption from an active volcano.

It was hard to believe. Some scientists were highly skeptical, and the news was not released until other possible causes—another moon in the background, a glitch in the imaging system—had been ruled out.

Now, however, scientists are fairly certain that Io contains at least eight centers of volcanic activity, constantly spewing its molten insides onto its blemished pale-tomato-colored surface. Io's volcanoes are without parallel on Earth. They are so large and active that, according to planetary geologist Lawrence Soderblom of Arizona, it's possible that Io has actually turned itself inside out completely two or three times since its formation billions of years ago.

Why is this happening to Io? Scientists suspect that Jupiter—

named after the Romans' chief god, the equivalent of Zeus—is largely responsible for the dramatic transformation. Because Jupiter is 318 times as massive as the Earth, the tidal forces on Io are hundreds of times stronger than the force Earth exerts on our own moon. In addition to that huge stress, Io's three big companion moons tug at it from other directions. All this tidal energy has to go somewhere, and scientists believe it manifests itself as internal heat, cooking Io's molten interior.

Soderblom, part of the NASA team at the Jet Propulsion Laboratory, says Io's surface reminded him of the red and yellow colors of a fumarole (a volcanic vent) around the geysers at Yellowstone National Park. He theorizes that the plains of Io are probably blanketed with salts and minerals left over after liquids belched from volcanoes have evaporated. This would explain the pizza-like coloration of the Ionian plains. In addition to gravitational buffeting, Jupiter also lashes Io with radiation. The minerals and salts on the plains of Io are constantly blasted by high-energy particles, propelled by Jupiter's intense magnetic field.

Bradford Smith suggests these highly energetic particles would knock atoms loose from the surface of Io, and over hundreds of millions of years could effectively gouge more than 100 feet of surface matter from the moon. Some of this radiation-scattered matter would remain trapped in the Jovian magnetic field, forming a doughnut-shaped ring encasing Io's orbit.

And just such a cloud was mapped by Voyager as the spacecraft flew right through it. Voyager has thus revealed a bizarre world—stretched, twisted and heated by enormous gravitational tides. These tides create extensive surface volcanism that blankets the moon with salts and minerals, which in turn get blasted into space through the action of a titanic magnetic field.

Other findings were more prosaic, but still surprising. Scientists saw the familiar—and expected—craters on Ganymede and Callisto, the largest and outermost pair of Jupiter's biggest moons. But these were no duplicates of our moon, either. Ganymede is broken by lateral shearing, "something like the San Andreas fault, but more complex and extensive than on Earth," says Harold Masursky, a member of the Voyager photo interpretation team. "This implies internal activity and internal heat for Ganymede, although on a smaller scale than Io." Callisto looks the most like our

(Please turn to page 102)

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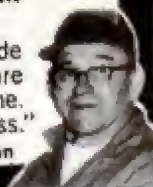
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10 YEARS BEYOND THE MOON

(Continued from page 100)

moon, but there are no big crater walls, just small craters. Masursky says density measurements of Callisto show that about half of its mass is frozen water.

On to Saturn's rings

One moon of ice, another turning itself inside out, a previously unknown ring—Voyager 1 transmitted a crop of surprises like these before breaking away from Jupiter and arcing, at 52,000 mph, toward Saturn. There the powerful Voyager cameras will be able to pick up chunks in the rings the size of a large office building, if they exist. In the meantime, Voyager 2 is expected to harvest new data from Jupiter during its encounter July 9. Following a more cautious route to help insure its health all the way to Uranus, the second Voyager will fly a path about 400,000 miles from the planet, compared with Voyager 1's locus 174,000 miles above Jupiter's clouds.

If all is going well, however, you can expect this month to get better views from Voyager 2 of Ganymede, largest Jovian satellite, and Europa, slightly smaller than Earth's moon: Voyager 2 will pass closer to both of them than its predecessor.

Should both Voyagers' radios remain healthy, engineers expect to be able to keep in two-way communication well into the 21st century, when the craft are far beyond Pluto's orbit.

When robots need help

Two-way communication? Yes, the fact is these powerful and apparently self-sufficient robots sometimes need a little human help in space to carry on their mission to the giants. Early last year, for instance, a small, movable platform to hold some vital measuring instruments on Voyager 1 lost most of its ability to move around at the end of a boom. The lack of mobility threatened to cripple the exploration. Three months of investigation determined that a small amount of soft, pliable debris—apparently retained in the unit during its assembly—had found its way into the gears.

The solution was similar to a prescription for a charley horse: NASA scientists commanded the platform to keep moving slowly through the problem area until the bits of debris were crushed by gears, freeing the platform, saving the mission, and proving that human ingenuity counts even where humans can't travel themselves.

FM

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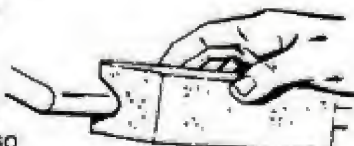
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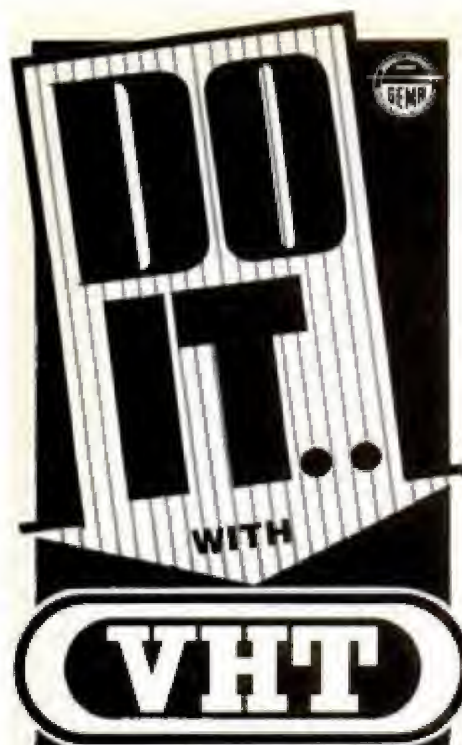
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RETURN OF THE ROADSTER!

(Continued from page 65)



Two extremes: Aston Martin's rich Volante (above) is a V8-powered production convertible in \$70,000 range. Do-it-yourself Blakely Bearcat at right runs \$5000 to \$10,000, depending on how much customizing you want to do beyond the price of the basic kit.



by way of Zagato, the famous Italian coachbuilding firm. Zagato takes delivery of the body from Lancia and makes the conversion to a convertible. Zagato earlier engineered a similar design for Bristol, a luxury-carmaker in England. Reportedly, the Bristol convertible will also be imported to America if it can make its way over the federal safety hurdles.

Driving the Lancia Zagato is not quite the same as driving a full "open" convertible because the window frames above the doors add rigidity to the chassis.

Rounding out the list of completely topless cars that come new from European manufacturers are the Fiat Spider 2000, VW Beetle (yes, you'll still be able to get one of these, for a while yet, anyway) and Rolls-Royce Corniche convertible. Other manufacturers with cars that open up to some degree are Fiat (X1/9), Porsche (911SC) and Ferrari (308GTS). We don't count Detroit's T-tops. They don't open up enough to be included here.

Conversions

The second group of convertibles available in the U.S. market as of 1979 is a brand-new crop—the conversions. When Detroit automakers stopped making convertibles, suddenly there was a large "shortfall" created between the still-existing demand and the hundreds of thousands that Detroit used to sell annually. Detroit automakers could justify cutting convertibles because of their "low" sales—to Detroit, anything under 50,000 units is not worth bothering about. That left the market wide open for conversion firms which convert hardtops and sedans into convertibles.

It takes a lot of engineering to convert a sedan or hardtop into a convertible. It's not your ordinary back-yard project, since today's unitized bodies depend on the body structure itself for the whole car's

strength instead of using a separate frame and relatively unstressed body as in the "good old days."

This cost—of engineering a convertible correctly so that it is as watertight and quiet as if a Detroit automaker had built it—is what makes the conversions so expensive. (But on an expensive car to begin with, like a Cadillac Seville, cost may be no object.)

Undoubtedly one of the finest conversions available in 1979 is the one made by Coach Design Group, Inc. It is essentially a redesigned Cadillac Seville, sold under the name San Remo (base model) or San Remo Ultima (deluxe model).

Coach Design takes delivery of as many as 20 brand-new Seattles a month in its Westlake Village, Calif., plant. The redesigners proceed to cut the four-door car apart and make it into a two-door, and then to add the convertible top structure. The convertible top is power-operated through a switch on the dashboard.

The seats are re-covered in a finer leather grade and a console is installed. On the more deluxe San Remo Ultima, the bucket seats are more form-fitting and a center console in rosewood is added.

Because the San Remo convertibles can be compared in quality and ride to the Rolls-Royce Corniche convertible (which costs more than twice as much!), it makes sense for Coach Design to offer the finest options, such as Connolly leather, which is also used on the Rolls.

The grille is changed from that on the stock Seville, and it's probably no accident that the grille resembles that on a Rolls, as well. To set the Ultima apart from the lower-priced model, the Ultima has its headlights set into freestanding pods while horizontal taillamps are used in place of the regular taillamps. Some California custom-type options are avail-

(Please turn to page 106)

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RETURN OF THE ROADSTER!

(Continued from page 104)

able, such as a rear deck lid with a spare wheel and tire integrally mounted, or simulated side exhausts.

Thirty coats of lacquer

The San Remos are painted all over again from scratch, in 30 coats of lacquer that are hand-rubbed between coats. The suggested retail price is \$46,000 for the base San Remo and \$48,000 for the San Remo Ultima. The drive trains of both are covered by Cadillac's warranty because nothing on the drive train was touched during the conversion.

In a sense, the Coach Design Seattles are merely picking up where we left off back in the 1930s, when the wealthy bought a chassis from Rolls-Royce, Bentley or Hispano-Suiza and sent it to a coachbuilder like James Young or Saoutchik to be bodied in a choice of designs—like sending cloth to a tailor to make up a suit. In the late '30s, the coachbuilders began to die out and automakers began to offer standardized body styles on their chassis. Even Rolls took on a couple of coachbuilders "in house," including Mulliner-Park Ward, which still builds the Cor-niche models.

At those prices, are we talking about reality? Well, look at it this way. Is a Seville convertible at \$48,000 any more unrealistic than a Rolls convertible at more than \$100,000? Which car can you get serviced at midnight in Fargo, N.D.? For which can you buy a fender with one day's wages?

What Coach Design did was what Cadillac *should* have done. If Cadillac had done it, the price would be more like \$25,000 each, since Cadillac could produce at least 15,000 units per year. But Cadillac, through lack of interest, didn't do it and Coach Design did. They have an investment in their tooling and engineering, and their price includes a hefty profit for the dealers because it takes a lot of moxie to ask a Cadillac dealer to try to sell a car that's priced almost four times higher than his highest-priced model from the factory.

There are many other firms doing conversions, including another on the Seville done by Milan Coachbuilders in Simi Valley, Calif., who make a two-door Seville convertible on a shortened chassis with a hand-operated softtop. The styling is a little bizarre, but with 700 pounds less weight, it has more performance, better mileage and—best of all—a price tag in the \$30,000 range.

A volume of business is also done by American Custom Coachworks, Box 1220, Beverly Hills, Calif. 90213.

At this writing, there are plans afoot to create convertibles on Datsun Z-car chassis, '79 Mustang and Capri chassis, and the full-size Cadillac chassis. All will be priced substantially above what De-

troit automakers would charge—but the market is there.

The vintage redo

There is a third way to get a convertible—simply buy an old one and restore it. Detroit automakers made literally *millions* of convertibles before Cadillac made the last one in 1976, and many of them are still on the road because the scrap-page rate on convertibles is traditionally lower than on sedans and hardtops.

The problem with buying an old convertible and restoring it is first of all finding one that is *worth* restoring. Some old convertibles have nice lines, but that doesn't make them worth spending money on. Before you invest in one, it's a good idea to buy some reference material like the *Old Car Value Guide* (Old Cars, Iola, Wis. 54945) to find out what models of various years are going for.

For instance, take two models from the same model year—a 1967 Mustang and a 1967 Barracuda convertible. The Mustang convertible is worth anywhere from \$2500 for a rough, unrestored specimen to \$4500 for a restored model. The Barracuda is worth only from \$350 to \$1500.

Why? Because there is no cult built up around old Barracudas like there is around the Mustang. The Mustang is by far the best investment in a used convertible, simply because there are so many Mustang owners' clubs that interest in the marque is constantly building.

Undoubtedly, some of the worst bets in convertibles to restore are the large gas-guzzling models like a Pontiac Bonneville or Chrysler convertible. With the prospect of gas going to \$1 a gallon soon, these big models would be hard to unload if you get tired of keeping them in fuel yourself. The only exceptions are the largest and grandest of convertibles, such as Eldorados or specialized limited-production models like the Chrysler 300 "letter car" series. Even a gas-guzzling appetite won't affect the value of a convertible that also happens to be a specialized model. Mercedes 450SLs and Jensen Interceptors also fall into this class. They may have gas-hungry V8s, but they were produced in such small volume and are so grand in concept that they will continue to appreciate rapidly.

Another reason old convertibles, and old cars in general, are growing in popularity lies in the ability of an old car to rekindle those golden memories. What wouldn't you give to have a mint '57 Chevy convertible like the one you drove in the homecoming parade in high school? Or what about the summer you and your buddy spent cruising around in that Bonneville convert? Where is that car now?

Nostalgia for the old days

With the media exposure of movies like *American Graffiti* and *Grease*, old cars are suddenly in demand as nostalgia in-

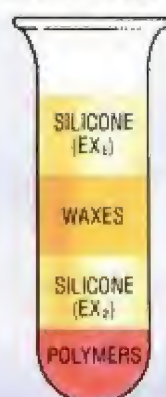
(Please turn to page 109)



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RETURN OF THE ROADSTER!

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vokers. Maybe you won't really feel 20 years old again in a 20-year-old convertible, but that doesn't stop a lot of people from coming into the old-car hobby to try to recapture the "good old days."

One cautionary note that is sobering is that old convertibles are also old cars. And "old cars" translates into "used cars." That means they could have been smashed and rebuilt, rusted clear through and patched, or have a number of suspension pieces about to break from sheer metal fatigue after hundreds of thousands of miles. You have to look at an old convertible as a used car and price it as such. Certainly, it's seductive when the top goes up and down, but remember that old convertibles probably have many more miles on them than the odometer says.

You don't have to do all the work yourself. Specialty shops are popping up. American Convertibles in Chula Vista, Calif., is one. Another is in Beverly Hills:

Jay Brunk, a 42-year-old Californian, saw the demand for Mustang convertibles a year and a half ago and founded Beverly Hills Mustangs Ltd. (9289 Alden Drive) in a 25,000-square-foot warehouse. Inside the warehouse there's a beehive of activity as Mustangs are reupholstered, new tops attached and engines rebuilt.

Outside the warehouse more than 50 Mustangs sit awaiting restoration, some with dents, some with convertible tops torn to tatters, but all worth restoring.

Brunk, with 12 employees, reports he will gross \$1 million in 1979. He restores cars belonging to private customers at the rate of about 20 per month. He promises delivery of a finished car in one month's time. In addition, he owns about 20 Mustangs himself that he restores between customers' cars.

Why are Mustangs so popular? "What's happening," says Brunk, "is that people are going into the new-car showrooms and looking at the cars and looking at the prices and not seeing anything they like as much as their old Mustang. They go out and look at their old Mustang and say 'Hey, I've always loved this car. So what's \$3000 to restore it and make it like new?'"

Restorations are good bargains

"The finished, restored car is better than anything they can buy new for \$6500," says Brunk, "and they can enjoy the car all over again."

Although Brunk didn't say it, there is also the instant depreciation factor inherent in most new cars, with most of them dropping 25 percent in value as soon as they are driven out of the showroom by a buyer. With restored cars, the value goes up with the restoration.

Brunk discourages customers from getting only a "touch-up" on the paint, be-

cause the car won't look complete. He prefers to do complete paint jobs where all the chrome trim is taken off, the car is painted and the chrome is put back on again. He also adds original parts called "new old stock" where possible and only uses a reproduction part when absolutely necessary. (That's another advantage to restoring a Mustang—there are many reproduction parts coming on the market.)

Brunk also refuses to paint the cars any other color than the stock Mustang colors offered originally.

"What we're after is a complete redo of the car," says Brunk, "replacing every screw with another original Ford one."

The only change that Beverly Hills Mustangs makes in a car is the installation of a glass back window in the convertible tops of 1965 and 1966 models, which originally didn't come with that option. "We find it seals better and looks better," says Brunk.

Brunk also refuses to change the engine from the specs it came with. For instance, if it came with a two-barrel V8, he discourages changing it to a four-barrel.

Brunk says that a convertible GT is the most desirable of Mustangs (unless you count the six Shelby GT-350 convertibles made in 1966). This is because the GT had fancier interior trim, disc brakes, twin fog lights in the grille, "trumpet" extensions on the dual exhausts and a more powerful engine than the other models.

Brunk points out that the code printed on the door identifies how the car was originally equipped. Various Mustang clubs can provide literature showing how to interpret these codes.

Watch out for fakes

Brunk warns that there is a lot of misrepresentation going on with Mustangs because they are so popular, with fake GTs being made, and even fake Shelys. "It behooves one to buy all the books available on the subject so that you don't get ripped off," he says.

Brunk admits to owning an old Jaguar sedan himself and says that, before he got into Mustangs, he was the owner of many exotic foreign cars, financed by his work as a TV writer. "One day my son was going on a heavy date and he talked me into trading my 1954 Mercedes 300S for his Mustang for the night of the date. I enjoyed driving that Mustang convertible so much that I saw the possibilities for restoring them."

Beverly Hills Mustangs charges according to what you want done on your car. The average price for a restoration is around \$4000, which is often more than it costs at present to buy an unrestored Mustang. But since restored ones go for \$6000 and more the investment is "recapturable."

The type of restoration that Beverly Hills Mustangs does is not to be confused with the type of meticulous, cost-is-no-ob-

(Please turn to page 111)

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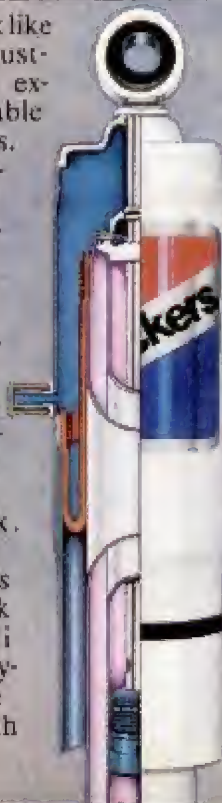
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RETURN OF THE ROADSTER!

(Continued from page 109)

ject restoration done by concours d'elegance competitors. Concours competitors, especially those from Harrah's Auto Museum in Reno and Otis Chandler's collection in Los Angeles, often make each part of the car better than it was originally, creating perfect "100-point" cars. With a top dollar of around \$10,000 for a Mustang convertible, it would not justify this type of "ground-up" restoration if you planned on eventually selling it and breaking even. But who knows? Mustangs could become even more valuable as the cult grows and even a ground-up restoration could pay off if you save money by doing the work yourself. Already there are ground-up restorations in progress on 1965 Shelby Mustang GT-350s, the most valuable of the Mustangs because of their racing history.

A boon in gas shortage

One of the advantages of restoring an old convertible is a short-run advantage, but still one to be considered: the ability to burn regular or premium gas. At this writing, unleaded gas is already limited on the West Coast and the predictions are for bigger shortages nationwide in the summer of 1979. People may laugh at your tatty old 1965 Mustang at first, but when you can buy regular for it while they can't buy unleaded for their 1979 models, who has the last laugh?

Here are some recommended used convertibles that the author predicts (but doesn't guarantee) will appreciate every minute you own them. *Foreign two-seaters:* Any Jaguar XKE, 1967 Sunbeam Tiger, 1971 Jensen-Healy, Jensen Interceptor III and Mercedes 23-250-280SL and 450SL. *American midsize:* Any year Corvette, 1955-57 T-bird, any year Mustang (especially '65 through '68) and Cougar CR-7. *American dreamboats:* Chrysler 300, Chrysler Imperial, Eldorado and Lincoln four-door.

Kit cars

Last but not least as a source for convertibles are the kit-car manufacturers. Many of these ragtops are based on classic designs and were shown in PM's *Cloning the Classics* (Nov. '78, page 100). We included a list of the makers at the end of the story. A good guide to the kit-car field comes from Auto-Logic, Inc., Box 2073, Wilmington, Del. 19899. Its *Complete Guide to Kit Cars* costs \$5.

Manufacturers of most kit cars sell fiberglass bodies that are installed on various chassis, most often the VW Beetle. You save money by doing all the work yourself, but if you don't want the skinned knuckles, you can buy a finished car from makers who do the work in their shops.

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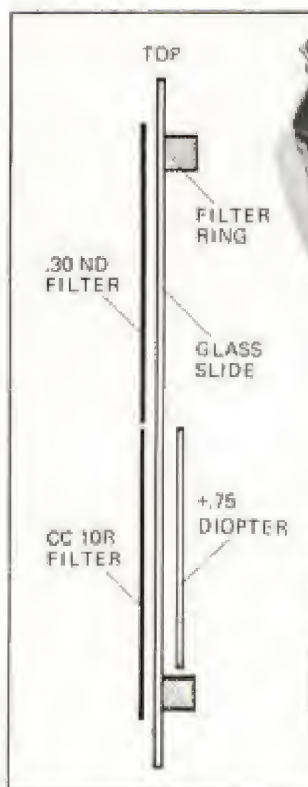
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(Continued from page 61)



Filter ring, at left, holds a +.75 diopter lens in lower half to make underwater images same size as above-surface subjects. Taped to glass slide cemented to ring are a gelatin CC 10R over lower half for color correction underwater, a .30 ND filter at top.

Bottom of split-image housing shows 22 lbs. of lead diver weights to help rig float level.

gle viewing accessory. Spiratone, 135-06 Northern Blvd., Flushing, N.Y. 11354, is one mail-order source.

With my camera, I use a motor drive for convenience and a medium wide-angle 50-mm lens (a 35-mm focal length lens on a 35-mm camera gives about the same field of view). The wide angle allows working closer to the subject for an improved underwater image and less chance of diffusion from the water. Pick the clearest, calmest water you can find for a sharp picture with a distinct division waterline. For these specialized photos, I often choose Florida's Crystal River area where the clear, spring-fed water has minimum sediment.

For the transparent faceplate, I chose a 30-inch-diameter plastic dome that gives me a 15-inch radius of view from the lens. A 35-mm camera can use a smaller dome and shorter radius. Recreational vehicle and van accessory stores are one source for these hemispheric bubble windows. Four cuts square the dome, as shown in the diagram, by removing 7½ inches from each side to fit a 15-inch-square aperture.

Building the camera housing

The camera housing, constructed of ½-inch marine plywood, is a box approximately 10 inches square and 9½ inches deep. The front has a circular hole, through which the lens extends into a 9½-inch housing that expands out from a 6-inch square to

the 15-inch that mounts the plastic dome. In the top of this lens housing, an access port cover is secured with wingnuts and can be removed to fit and adjust a filter holder on the lens, focus or make diaphragm adjustments. All plywood joints are waterproof-sealed with marine silicone sealant during assembly. All surfaces, inside and out, are painted flat black to reduce reflections.

The result is a very buoyant box and you'll need to add weight to make it easier to hold semisubmerged in the water. For my size housing, I found that six 3-pound lead skindivers' belt-weights under the dome and two 2-pounders at the back of the camera box balanced out the rig, after being attached to the bottom. Hand grips are mounted on each side of the box and a cable-release is positioned near one thumb.

Since water reduces light transmission, changes focus and shifts color balance, I worked out a compensating filter packet. A +.75 diopter lens was cut in half by an eye-glass repair shop and mounted in the lower half of a filter ring. It gives underwater objects the same relative size and focus as above-water subjects. Over it, a Kodak CC 10R color-correcting filter improves color balance, while the top half is a Kodak Wratten .30 ND neutral density gelatin. This arrangement cuts overall light level a full stop, for which either you or your camera must compensate. Result: a fine over/under photograph. **PM**

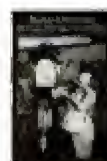
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WORKSHOP MINICOURSE

ADD-ON FENCE SOLVES BENCH-SAWING PROBLEMS



Wooden auxiliary fence is a must for certain cutting problems. Clamp the board (here a 1x6) to saw's rip fence, use an awl to mark the screw locations.



Countersink the holes on saw-blade side of the fence, so the bolt heads will be flush with its surface. Use $\frac{3}{16}$ x 2-in. flathead bolts and wingnuts to fasten.



Secure auxiliary to fence as shown—with board on the blade side. Tighten wingnuts securely so the board can't move.

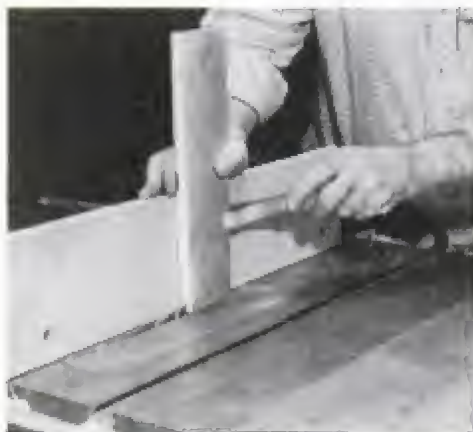
To get the most use from your bench saw, it is imperative that you learn the correct methods for making the difficult cuts. The basic rule for using a bench saw is to make certain that you always hold your hands so that if something goes wrong, your hands will go past the spinning blade, instead of into it.

Today's bench saws come equipped with blade guards, and it is a good idea to use the guard whenever practical. In some sawing instances, many veteran saw users (including this one) feel that the saw is more hazardous with the guard on. The smartest rule of thumb is to use the guard whenever possible and other, shop-made, safety devices if you find it necessary to remove the guard.

Make an auxiliary fence

This is one of the first accessories that you should make for your saw. It is a must for making the cuts shown above, and there are other cutting operations (which we'll cover in a future issue) that require this safety add-on. My auxiliary fence consists of a straight length of 1x6 clear pine cut to span the saw table. Locate and bore pilot holes for the bolts which hold the auxiliary against the primary fence. Countersink the holes so that the bolts' flat heads will be buried in the fence's surface. Otherwise, the projecting screwheads could interfere with sawing operations.

Perhaps one of the most feared cuts by do-it-yourselfers is the into-end rip—and rightly so. If you were to try this cut using the standard fence only, you would run a high risk



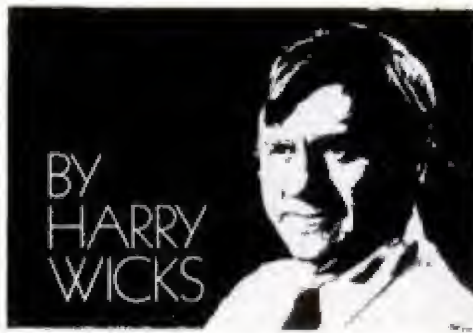
of the board wobbling and ultimately kicking back. Supporting the board with your right hand against a high auxiliary fence, however, you will retain steadiness and control that is otherwise impossible. The right hand rides the auxiliary fence top—well away from the blade—while the left hand is equipped with a pusher stick to keep the workpiece flat against the fence.

The problem is a similar one when making an into-edge rip. This cut is easily and safely accomplished if you use the setup shown in the lower right photo. Here, a length of straightedge is carefully positioned and held securely with a pair of C-clamps. This prevents any lateral movements of the board being cut. Your feed hand should stay in contact with the auxiliary fence, as it slides the workpiece into the blade. If preferred, a spring-type hold-



down could be clamped to the table to hold the workpiece against the fence. But I have found that the clamped straightedge insures greater rigidity.

You would be wise to consult your saw manufacturer's instruction booklet when confronted by any challenging or unusual cutting problem. You will find just about all problems are solved with jigs and devices like the auxiliary fence. **FM**



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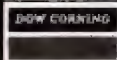
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PM LOOKS AT PENNEY'S SANDER-GRINDER



Author found this sander-grinder comfortable to use and supereffective.

Until now, I generally tackled a tough sanding or grinding job with a disc sander in a 1/4-in. drill. Sanding blistered house paint and removing auto-body rust spots require muscle, time and a tool that doesn't break down when it runs constantly. Now that I've used J.C. Penney's sander-grinder on several heavy jobs, my old electric drill can be saved for other tasks.

The Model 2850 sander-grinder feels comfortable and boasts a



Spanner wrench, needed for tightening pad nut, comes with the sander.

movable handle. The tool weighs 11 lbs., which isn't arm-wearying when you realize the 7-in.-dia. disc removes a lot of material with every pass. At \$84.49, it's a good buy. Penney also offers a similarly efficient sander-polisher.—H.W.

SPECIFICATIONS—SANDER-GRINDER

Model: 2850 (sander-grinder); 2900 (sander-polisher).
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Weight: 11 lbs. (both).
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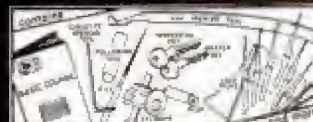
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Ohio Man Discovers The Secret of How to Escape The American Rat Race

7 Simple Rules Net This Working Man Without Any Money or Experience \$145,000 in First Year

By John Whitehead, Special Features Writer (Canton, OH) The secret to making a quick fortune in America has been reduced to a simple 7 step system by an entrepreneur from Canton, Ohio. It requires little or no money, a minimum of time and no elaborate plant or equipment. In fact, you can do it in your home or anywhere.

The man who did it is Ben Swarez from Canton, Ohio, the Pro Football Hall of Fame city. There are hundreds of rags to riches stories each year in America. However, his is very unique. Ben's system is geared to the working man who is living from pay to pay, no savings or assets, working an 8 hour a day job for a big company, no experience and no rich relatives.

For the secret of how he achieved his workingman's way to riches, I held the following interview with Ben.

My interview with Ben was very lengthy and detailed, and I could never come close to fitting it on this page. The most interesting part was towards the end. At the beginning of the interview Ben related how he arrived at the 7 steps to generate net wealth. He calls these 7 steps a Net Profit Generator System, or N.P.G.S. for short. The story on how he arrived at the N.P.G.S. system is lengthy and also incredible. It was no easy task. I will try to summarize.

It all started when he was typical of a majority of Americans, working for a large corporation and being unable to make ends meet. One day the last straw came in a string of frustrations which made him decide to go into something for himself.

He started out by trying to start orthodox businesses, but soon found himself, as all starting businessmen do, heavily in debt. Then one day while exercising, of all things, he had what he calls a tremendous insight on how to make money quickly.

As he put it, "the idea rolled out of my head like a computer printout." It was the 7 step method, the N.P.G.S. system. But even that didn't come easy. The first N.P.G.S. systems failed miserably. But, Ben could see that his concept was valid and only needed to be perfected. He finally did perfect the system and his first successful system was called N.P.G.S.-4. Within a few weeks N.P.G.S.-4 netted him enough money to pay off all his back debts and have \$80,000 left over for profit. It was such a glorious day that I wanted to pick up on the interview at this point.

QUESTION: That is incredible. Within a few weeks N.P.G.S.-4 netted you enough money to pay off all your back debts. You had in your hand \$80,000 in cash as net profit. I can't even imagine getting that much money all at once. What was it like?

ANSWER: It's almost impossible to verbalize. My wife and I just stared at the check for a long time. We had a two day celebration with a dinner and party. It's a fantastic experience to go into work and tell them you quit. The chance to say what you truly feel to people who have had you under their thumb for 10 years is truly a pleasant release of frustration.

The first thing I did was pay off all my bills. Then I paid off my house. I took the money to the savings and loan company who held the mortgage personally to see the looks on their faces. After, we had a "burn the mortgage" party. Next I went to the showroom of the local Lincoln-Mercury dealer and laid down the cash for a brand new Mark.

My wife and I went on a shopping spree for clothes. We had been making do with old clothes for so long they had become worn out. She always had to shop for clothes with very little money. I always joked with her that "If I gave you \$5,000 to spend on clothes could you do it in one day?" She used to say "I could do it in a

couple hours." So that's what I did. I gave her \$5,000 to go out and buy clothes.

We then took a long vacation. In New York I bought her a large diamond at Tiffany's — another thing we always dreamed about.

But, what money really does is give you precious time. Time to be with your wife and children before they grow up before you know it — and time to do things you really want to do. Another priceless thing you gain is your self respect. The words of Frank Sinatra's song "My Way" says it all.

QUESTION: This definitely could be a movie script. How did things go after that?

ANSWER: Excellent. The same year I assembled two more systems and made a total of \$145,000.

QUESTION: You've been at it for 3½ years now. Were the succeeding years as good?

ANSWER: Better. Here are the results by year: The 1st year as mentioned I made \$145,000; the 2nd year I made \$205,000; and 3rd year \$309,000. And already in the first half of this year I have made \$200,000. I have audited financial statements from certified public accountants and income tax returns to verify this to any agency or investigator of any kind who wishes to challenge me on this.

QUESTION: That's quite a system. I understand you're now ready to tell everyone how you did it.

ANSWER: I don't know if I'll tell everyone. But, I have put it all into a set of step-by-step instructions. It contains the complete simple to understand details on how to assemble an N.P.G.S. system which I finally reduced to just 7 simple steps. Here are some highlights of the qualities of the system:

- The system requires a minimum of time and money to start.
- You don't need special experience or skills to do it, and it's not a salesman's job.
- You don't need to buy or rent buildings, buy or rent equipment and you don't have to hire people.
- You can do it anywhere — in your house, while you travel or a favorite vacation spot or retreat.
- With the system you can earn \$10,000 to \$500,000 in a matter of months and even within two days depending on which system you assemble.
- The money you make is all earned income which is subject to one of the lowest tax bites.

QUESTION: Did you say you can make big money within days?

ANSWER: No, that's an understatement. You can actually do it within hours in some cases. You can compile a system in an afternoon one day and start having spendable money in your hands produced by the system the very next morning!

QUESTION: How much money do you average on a system?

ANSWER: I'd say the average is \$200,000. That's the type I usually stick to. I'll tell you this, doing a system to make \$10,000 to \$20,000 is literally duck soup. I have these available all the time but don't even use them.

QUESTION: You said you need no special talent or experience. Who all can do it?

ANSWER: You only need to follow directions. All you need is common sense, a sense of pride in your work and the ability to see a job through to completion. This system is also perfect for people who are confined at home, such as housewives.

QUESTION: O.K. So, why do you want to reveal your system to other people when it's obvious you're making loads of money with it?

ANSWER: Everyone likes to brag when they accomplish something; and, I'm no different. Second, I am in the position now to completely

Says you can do it anywhere. He does it while traveling in his motor home.



Swarez does his system in his motor home while his wife, Nancy, drives and his two daughters, Sharon and Michele, play and sigh-see. That's the family's pet shetland sheepdog on a favorite perch.

retire. I have put all my money into a diversified portfolio of blue chip investments that no one can touch, including myself. So, I'm protected from losing my money myself or someone taking it away from me.

QUESTION: I shudder to ask, how much does your system cost?

ANSWER: Would you like to guess? I'll give you a hint. Keep in mind this is a system designed for the working man like I was, and must be affordable to him.

QUESTION: Well, I know proven money making systems such as hamburger franchises cost \$100,000 to \$250,000 plus overrides, and all you get for your money is their name and a handbook. But with your hint, and, also I know, you've been chastised by other entrepreneurs for giving away the store. I'll say \$500.00 to \$1,000.00.

ANSWER: No, I've made it a very token price, just enough to keep away insincere people. I've done it for reasons I don't care to discuss, but, it has something to do with the unwritten law of when you take something out of the land, you have to put something back. The price is only \$20.00. I don't want to sound like a philanthropist, though, the fact is that I will still make money at that price. However, I could have made much more.

QUESTION: That's an unrefuseable deal. I am looking at the system. It's incredible. You could not get this money making information if you spent \$30,000.00 for a Ph.D. from Harvard. Thank you for a most interesting interview.

For those who wish to obtain a copy of Ben's N.P.G.S. system, it's called "7 Steps to Freedom". Here's how to order:

To order: 1) Get a blank piece of paper; 2) At the top of the paper, print the words "7 Steps to Freedom"; 3) Print your name and address; 4) Mail this along with \$20.00 in cash, check or money order to Quality Consumer; Dept.G-129 4626 Cleveland Avenue N.; Canton, Ohio 44767.

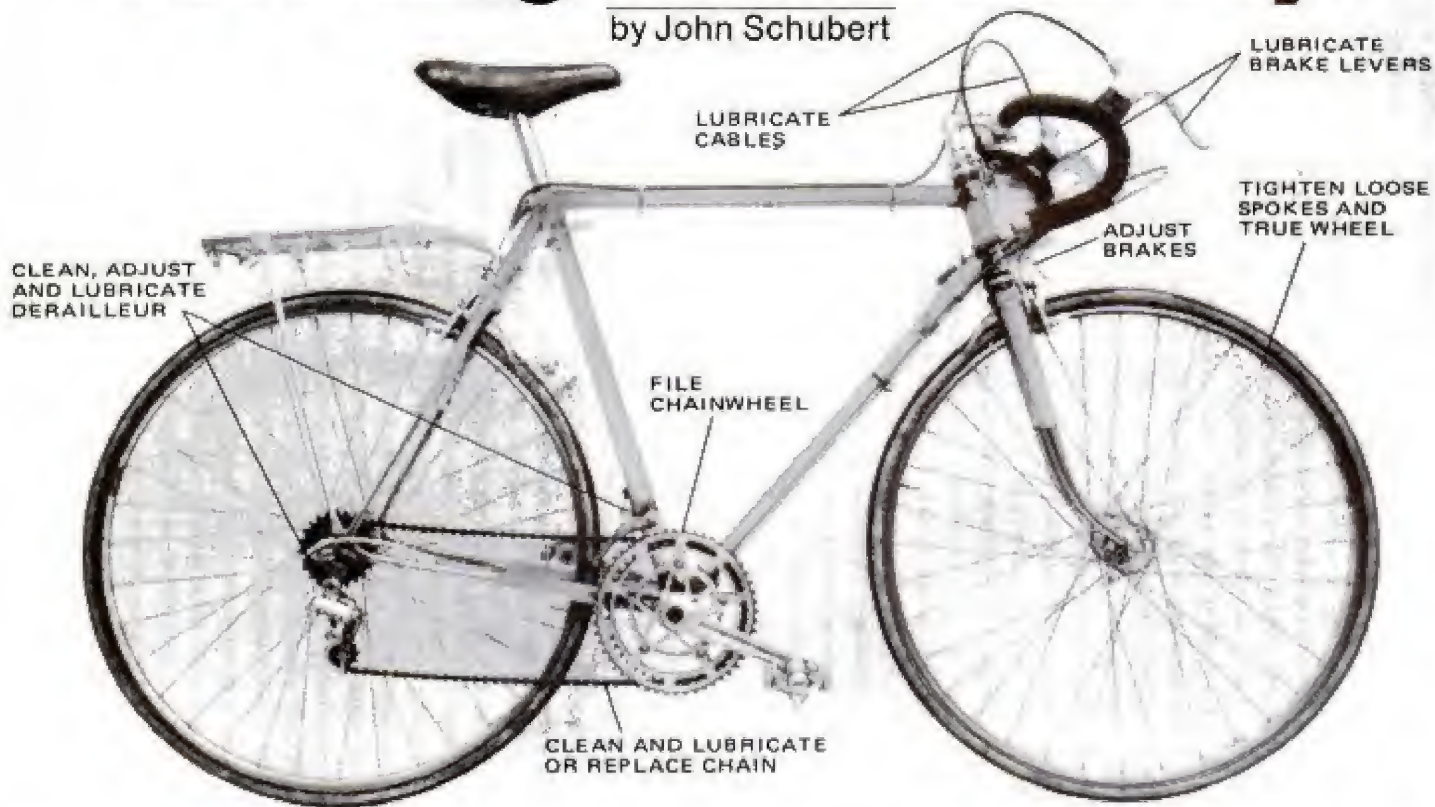
Or, if you want us to start processing your order immediately, phone in your order as follows: 1) Dial this TOLL FREE number, 1-800-321-0888 (Ohio residents dial 1-800-362-0636) and ask for operator G-129 ; 2) Say the words "7 Steps to Freedom"; 3) Give your name and address; 4) Give the operator one of your following credit card numbers: Master Charge or Visa (also include your Interbank number). Or, if you don't want to use a credit card, tell the operator you want it mailed C.O.D. Operators are on duty right now and around the clock.

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Tune up your bike for riding ease and safety

by John Schubert



Bicycles run almost forever without maintenance, right?

Wrong. There are many good reasons why you should spend the time and effort. Here are a few:

■ **Safety.** About one-fifth of all bicycle accidents serious enough to warrant a hospital visit are caused by equipment failure, according to the Consumer Product Safety Commission. Some bicycles are so neglected that they're accidents waiting to happen.

■ **Cost.** Most bike shops now charge \$15 per hour or more. The tasks shown here would run \$30 or \$40.

■ **Ease.** The bicycle is the world's most convenient machine to maintain in good repair.

Getting ready

Look over your bike with this article in hand and make a list of everything you need for the jobs you'll be doing. You'll certainly need bearing grease and lightweight oil, and you may need kerosene for cleaning dirty parts.

Line up the tools you probably already have—needlenose pliers, large and small screwdrivers, wire cutters and an adjustable wrench. Arc-joint and locking pliers are always helpful. You'll also need some tools you probably don't have. If

(Please turn to page 122)



1 Frayed cables like that above should be replaced. An easy, inexpensive fix, this assures you of maximum control.



2 Greasing cables may not be much fun, but it's essential for safe biking. Don't be afraid to slather on lots of goo.



3 Your bike may have cables as long as one on the right, but they should be shortened to look like the one on the left.



4 Sticky brake levers should be sprayed with lubricant. If they still stick, bend a bit sideways and relubricate.

Henry Morgan says: "Good appliance repairmen are scarcer than doctors who make house calls."

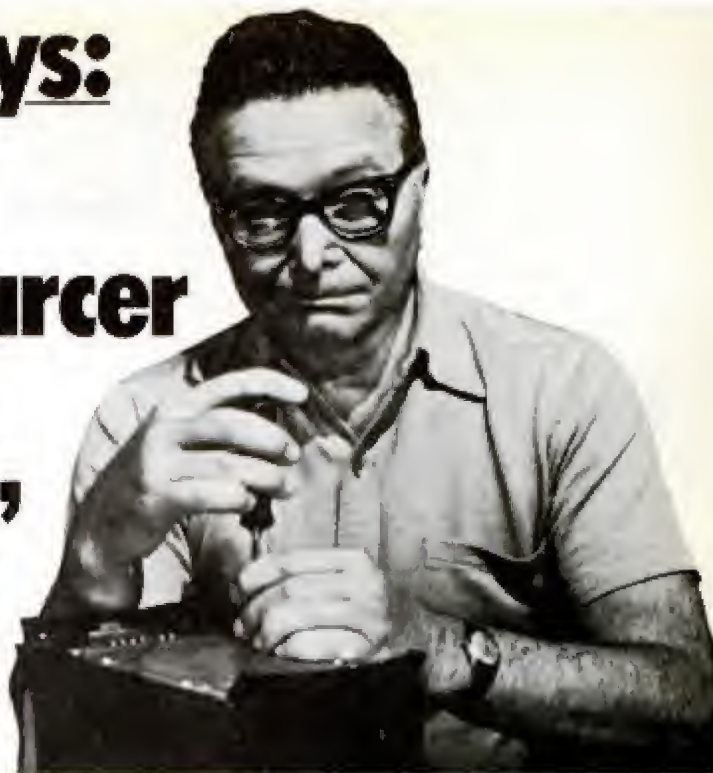
Did you know that there are over a billion appliances in use in the United States today? And three repairmen. At least that's the way it seems when one of mine goes on the blink. With more than two dozen electrical gadgets in my house going snap, crackle and pop, I finally got tired of trying to locate a guy with enough ambition to take my money and I decided to learn how to make the repairs myself.

When a well-aged comic like me decides to go back to school, you can bet the family jewels it won't be back at P.S. 93. I'm going to learn at home, or not at all. So I sent away for NRI's home study course in Appliance Servicing...and I took the course.

With a mechanical aptitude slightly below that of King Kong, I needed a course that started at the beginning and didn't move ahead too fast. Well, NRI did just that. They started with electricity — what it is and what it does — and went from there. You proceed at your own rate of speed. Whip through it if you want to, or take your time. What counts is the fact that you learn, in a way that it sticks with you.

You learn two things: how to repair appliances — from food processors and microwave ovens to refrigeration and air conditioning equipment — and how to get started in your own appliance business. That can mean money for you either way. If NRI can turn old ten thumbs Morgan into a reasonable facsimile of a repairman, think what they could do for you!

NRI's no fly-by-night outfit. They've been training people for more than sixty-five years...and they've had over a million students. It's the oldest and largest home study school in the field of electronics and electricity, so they know it better than anyone else around.



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In just a few months, you'll be fixing your own appliances like I do. Then, you can start earning spare-time money fixing them for your friends and neighbors. Before you know it, you can have your own full-time business and be independent.

Take my advice and mail the postage-paid card for a free catalog describing the courses, tools, and lessons in detail. Even if you don't know which end of a screwdriver is the handle, they can give you real professional training that'll help you break into the appliance repair field. It's one of the few things I've ever sent for that was even better than they said it would be. The NRI catalog is free and there's no obligation. No one will knock at your door or bug you at home. NRI doesn't use salesmen. They don't need them.

Take it from Henry Morgan, the appliance repair field could sure use some good men. Now. If somebody else beat you to the postcard, write to NRI at the address below.

Henry Morgan



Or look into these other growth fields

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5 To tighten a brake cable, use needle-nose pliers to twist it. Tighten the cable anchor bolt with a wrench.



6 To finish the job, use two wrenches to tighten cable anchor bolt. Be gentle, so you don't strip the threads.



7 First step in centering a side-pull brake is to tighten the two nuts in front of the brake against one another.



8 By turning the nuts at the front and rear of the brake in unison, you can easily center the brake over the wheel.



9 Chain should be cleaned and lubricated or replaced. If you can pick up a link this much, you should replace chain.



10 A chain tool is often needed to remove the chain. Use tool to push out a link pin, but not all the way.

your bike is anything other than an American one-speed, you'll need metric wrenches, usually in sizes from 8 through 12 mm. A second 8- or 9-mm wrench may be needed to hold a bolt still while you turn a corresponding nut (see below). A $\frac{5}{16}$ -inch wrench will fit an 8-mm nut.

You may need to go to a bike shop for a spoke wrench and a chain-link-removing tool. Get a tire-pressure gauge made for bicycles, too.

New parts may be in order—possibly new cables, cable casings, brake pads and/or a chain. All together, they should cost less than \$10. If you have to replace missing spokes, take the wheel in to compare spoke size.

A bicycle repair book will probably tell you to disassemble, clean and repack your bike's ball bearings twice a year. That's fine, but do the jobs pictured here first. They're a lot more important. (Never take the halfway measure of oiling bearings. The oil washes the grease out, then goes away and the bearing is left unlubricated.)

Start with cables

Your first and most important job is to inspect and grease your cables. Are they frayed and worn (Photo 1)? Replace them before they fail at a

crucial moment. If they are in good condition, you should still take them off the bike and grease them liberally (Photo 2).

Bicycles are frequently sold with cable casings that are too long. The extra length causes excess friction and slows brake response. If a casing is any longer than necessary to reach between its two end points in a smooth but small arc, remove the excess length (Photo 3).

About brakes

As a bicycle mechanic, I've been shocked by the poorly maintained brakes my customers trust themselves to. Brakes are such simple mechanisms that you should have no problem maintaining them. Disconnect the cables and see if your hand levers swing freely. If not, lubricate them (Photo 4). If the problem persists, bend them slightly sideways while swinging them. Add more lubricant.

If your brake pads have become worn unevenly by not striking the rim properly, buy new ones. Make sure they hit the rims squarely; adjust them if they don't. If your brakes squeal when you apply them, gently bend them so the fronts of the brake pads touch the rim first.

If you can squeeze the brake lever easily all the way to the handlebar, your brakes are too loose. Tightening them is often called a three-hand job (and a special tool called a "third hand" is often used), but you can do quite well with two hands. Take your needle-nose pliers and grab the cable just underneath the brake's cable anchor bolt. Loosen the anchor bolt and twirl the cable around the pliers like spaghetti on a fork (Photo 5). This will draw the brake closed onto the rim. Now take a metric wrench in your other hand and retighten the anchor bolt (Photo 6). All cables, especially new ones, stretch some—so expect it.

If your brakes aren't centered over the wheel, causing one brake pad to hit the rim before the other, or one pad rubs all the time (assuming the wheel is not warped; see below), you can fix them as follows:

For center-pull brakes, loosen the nut that holds the brake assembly to the frame, rotate the assembly to proper position and retighten.

Side-pull brakes aren't as easy, until you learn the secret. For most brands, you'll need two open-end 10-mm wrenches, one of them made unusually thin by a visit to your

(Please turn to page 125)

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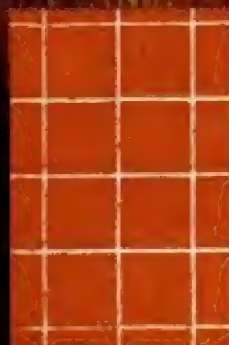
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by Joe Nazario, Mr. U.S.A. Physique Champion, 1977,
Mr. International, 1978

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- ☐ Develop a deep and powerful chest!
- ☐ Strengthen your back, thighs and calves!

I'm a professional body builder. I won the Mr. U.S.A. competition in 1977, and the Mr. International contest in 1978. I'll probably win Mr. Universe this year. I'm also in the exercise and health consulting business in New York City.

So I'm familiar with exercise and body building programs. I've probably tried every single one of them. And do you know something? Not one of them is worth the money you have to pay!

The reason is simple. Every so-called exercise machine, every weight-lifting set ever made works on one of two principles: isometric (putting stress on muscles that do not move) or isotonic (moving muscles under stress).

So, when you pay good money for a machine or a set of fancy equipment, you're buying a gimmick. You can accomplish *exactly the same exercise value*, get exactly the same results, without the machine—**IF YOU KNOW HOW!** What's more, since machines and weights put a tremendous amount of stress on weak, underdeveloped muscles, they can *actually cause more harm than good*.

THE SIMPLE LOCKER ROOM SECRET THAT REALLY WORKS, IN JUST 90 SECONDS

In my years as an athlete and as an "iron pumper," I've seen hundreds of men get ready for strenuous competition. Each had his own personal mannerisms. Each had favorite warm-up exercises. But over the years, I noticed a simple, common thread that was common to all.

I actually discovered the simple locker room secret that the pros use to build up their bodies in just 90 seconds!

That's right, using my secret, you can exercise *all 18 muscle groups* in your body in just 90 seconds. Eighteen simple exercises, every day, just five seconds on each. And within two weeks or less, you'll begin to notice the difference.

You'll **FEEL** stronger! You'll **LOOK** healthier, your body will be **FAR MORE ATTRACTIVE!** I'm not talking about tiny differences you can measure with a tape—I'm talking about *great changes* you'll begin to feel yourself, you'll notice in the mirror, your friends will notice on the beach!

WHAT IS MY AMAZING SECRET?

Frankly, it'll cost you \$5.00 to find out. After all, a secret as good as this one, a secret that will make your body stronger, healthier, better looking is worth \$5.00! But I'll give you a hint. It's a combination of the principles of *both* isometrics and isotonic. I call it "Tonometrics". And it requires no special equipment, no fancy gym. You can use my "tonometric" techniques and special "tonometric" exercises in your bedroom, bathroom, even in your office during your coffee break!

There are 18 special exercises in all, one for each of the 18 major muscle groups in your body. And each exercise takes just 5 seconds to do.

SEE THE RESULTS YOU CAN EXPECT FROM MY SECRET "TONOMETRIC" EXERCISE PROGRAM—DEPENDING UPON YOUR AGE:

If you are basically healthy and eat a balanced diet, the percentage of total performance can improve as follows using the "tonometric" program:

Age	Amount of Improvement	Age	Amount of Improvement
15	up to 100%	35	up to 180%
18	up to 130%	40	up to 150%
21	up to 150%	50	up to 100%
25	up to 200%	60	up to 70%
30	up to 200%	70	up to 50%

Of course, if you have a weak heart, or any physical disability, you should consult with your physician before beginning this or any other exercise program.

ABSOLUTELY NO RISK TO YOU!

When you send me your \$5.00, I'll send you a booklet explaining the "tonometric" concept, and outlining an exercise program using my 18 basic exercises designed to *trim down fat and flab...and build up weak, underdeveloped muscles*. **BUT I WON'T CASH YOUR CHECK FOR 30 DAYS!**

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What could be fairer than that? Since you've got nothing to lose, and only a beautiful, strong, firm body to gain, why not send me the coupon, and the check for \$5.00, today?



MEET JOE NAZARIO, CREATOR OF THE "TONOMETRIC" SYSTEM

Joe is 29 years old. He presently is in the health food business, and conducts seminars on health, nutrition, and exercise.

Joe has served as a consultant to industry, and gives private body building instruction. In 1977, Joe won the Mr. U.S.A. Physique Championship, and in 1978 he was named Mr. International.

Height: 5'10½"
Chest: 52"
Arms: 19"
Calves: 17"
Weight: 215
Waist: 34"
Thighs: 28"
Neck: 18"

**Joe Nazario, Dept. S-3
277 Northern Blvd.,
Great Neck, N.Y. 11021**

#98442

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grinding wheel. The single bolt on which the brake is mounted ends with two nuts holding everything together. Tighten those nuts against one another (Photo 7). Then, keeping one wrench on the two-nut assembly, put the other wrench on the mounting nut at the opposite end of the bolt. By turning your two

wrenches in unison, you can rotate the entire brake (Photo 8).

Caring for the chain

Depending on the care it receives, a chain may last thousands of miles or wear out in a week. A worn chain will shift sloppily and grind chain-wheel teeth to an early death.



11 After cleaning, when reassembling a chain with chain tool, use tool's inner notch to flex chain link sideways.



12 Two adjusting screws on this derailleur are side-by-side at rear of body. They're easy to find on other models.



13 A dirty derallieur should be thoroughly cleaned. Don't forget to remove chain rollers and clean them.



14 Bend nose of front derallieur cage slightly inward. The adjustable wrench keeps rest of cage from bending.



15 If chainwheel teeth need filing, place file between chainwheels, turn crank. Don't file aluminum parts.



16 Inexpensive spoke wrench eases wheel truing. Tighten or loosen opposing spokes in half-turn increments.

Greasing a bike cable

Greasing bicycle cables is drudge work, but it's even worse on a motorcycle, where removing the cable from the casing is more inconvenient.

Yamaha sells a time-saving cable greaser called the Power Cable Injector. The tiny device wraps a tight rubber collar around the cable and casing, with a small orifice for snorkel-tube lubricant. Insert the tube, push the button and the lubricant is forced down the length of the cable. In seconds, excess lubricant drips out the far end of the cable.

The Power Cable Injector is designed to accommodate a wide range of cable sizes. Motorcycle cables are much bigger than bicycle cables, but the tool fits all without leaking.

The injector worked well on bicycle cables, but we had two complaints: It commits you to snorkel-tube lubricant, when ordinary grease does a better job, and it costs \$4.50—more than the occasional bicycle mechanic might want to spend. But, if you have a garage full of bicycles, motorcycles, snowmobiles, mopeds and so on, you'll find the Power Cable Injector to be well worth the investment.—J.S.



What happens when a chain wears out? Wear and tear on its many rollers make the chain too flexible. You can check your old chain for wear by seeing if an individual link can be picked up off the chainwheel teeth, while the links flanking it are still engaged. If you can pick the link up any more than 1/8 inch, the chain is ready for replacement (Photo 9). You can help your next chain last longer by keeping it oiled at all times.

If your chain isn't worn out, but is dirty or rusty, give it a kerosene bath. It's easiest to take the chain off the bike for this job. If your bike is a 10-speed, your chain has no master link, and you have to use a chain tool to disassemble it.

The chain tool pushes a link pin clear of the roller it normally engages (Photo 10). This allows the chain to come apart. Be careful not to push the link pin all the way out

(Please turn to page 127)



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TUNE UP YOUR BIKE
(Continued from page 125)

the far sideplate, or it will be all but impossible to push back in.
Bathé the chain in kerosene and put a drop of oil on each link. To replace the chain, reverse your moves with the chain tool—reassembling the link—then use the chain tool's special notch to force the chain link to bend slightly sideways (Photo 11). This is necessary to make the chain flex freely.

Derailleurs not difficult

It's amazing that some people—including the authors of some bicycle repair handbooks—claim that a derailleur is too complicated for the cyclist to adjust. In fact, there are only five things you can possibly do to your derailleurs, no matter how fancy or simple they are:

1. Clean and grease the derailleur cables and casing, as described earlier. Take up any extra cable slack.
2. If necessary, adjust the high-gear adjusting screw. Every derailleur, front or rear, has one (Photo 12). Adjust it so the derailleur chain cage can easily engage the chain on the smallest sprocket (largest sprocket for the front unit), but can't throw the chain beyond the smallest sprocket into trouble.
3. Adjust the low-gear adjusting screw in much the same way.
4. Using cotton-tipped swabs dunked in kerosene, clean the entire mechanism. Lubricate it so it works freely through its full range of motion. If it's a mess, take it all apart and give it a kerosene bath.
5. In the case of the rear derailleur, you can apply extra lubrication to the two chain rollers so they spin freely (Photo 13).

For the front derailleur, you may want to bend the chain cage slightly (they aren't bent to the optimum shape at the factory). Bend both sides of the chain cage's nose inward about 1/16 inch (Photo 14). That will make the chain cage toss the chain around more aggressively. Position the front derailleur no higher on the frame than needed to clear the large chainwheel by a few millimeters.

Filing chainwheel teeth

If you've worked on your chain and derailleurs and still have front shifting problems, you may have dull chainwheel teeth. Chainwheel teeth should have a pointed profile, and expensive chainwheels are carefully machined to the proper shape. If your chainwheel teeth were not, you can dress them nicely with a file (but don't do this to alumi-

(Please turn to page 132)

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(Continued from page 73)

12.3 percent of our respondents listed fwd as a primary reason for buying, and 18.4 percent marked it one of the cars' best liked features.

Workmanship and overall quality also rated extremely high, with an average of 89.1 percent of our owners giving it a score of *good to excellent*. That's a fantastic endorsement, especially when you compare it with our ratings on the Lincoln Continental (71.9 percent), Cadillac Seville (74.4) and BMW (88.8).

Complaints about the Champ/Colt were few and far between. Wind noise at high speed brought out some low-volume grumbles, and one persistent gripe was with the transmission's normal shift mechanism. "Second gear feels a little notchy," observed an Oregon grocery clerk, and an Alabama student said, "The clutch is grabby pulling away from stop signs in low/low gear. It's very jerky. It's also hard to shift smoothly into second. I feel as though I've forgotten how to use a manual transmission."

On the topic of comfort, owners pretty much agree that this is basically a two-passenger car, with the rear seat reserved for short trips or short people. "There's not much legroom in back," vol-

unteers a Georgia enlisted man, "but I didn't buy it to put people in the rear."

An Ohio teacher: "People who are used to riding in compact cars find the rear seat very comfortable, while those used to big cars don't."

A California computer technician: "It's roomy enough for me, and it has a very smooth ride." A Minnesota secretary: "It's got good legroom and is easy to get into and out of." And a West Virginia regis-



Economy of 1600-cc engine is reported by Champ owners to exceed that of 1400-cc!

tered nurse: "Seems to have as much room for two plus cargo as my 1977 Monte Carlo."

The area behind the rear seat holds 13.7 cu. ft. of cargo with the seatback folded flat or 6.9 cu. ft. with it upright. The rear hatch lifts on twin cylinders, and a wiper for the large backlight is optional.

Another option—the full instrument package—appeared on a fair number of cars, but even the standard instrument panel includes fingertip controls for lights and wipers. The driver can reach these without removing his hands from the steering wheel. And electric controls for both outside rear-view mirrors come in all cars as unexpected standard items.

As for suggestions to improve the car, here's a representative sampling:

A South Carolina secretary: "Make the front end of metal, instead of plastic; they should offer factory-installed airconditioning, instead of add-on."

And a Minnesota electronics technician: "The oil filter location is terrible—very hard to reach because of the alternator. I plan to move the alternator top-side, using the tapped holes for the air-conditioner. I'll fabricate new brackets and get a longer belt, but it'll be worth it."

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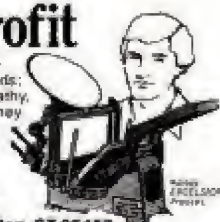
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For our grand finale, here are some general, unsolicited remarks that appeared on our questionnaires.

A California state park ranger volunteers, "I use all eight speeds all the time. Living in hilly country, I find the Twin Stick a dream come true. It's a joy to drive and a refreshing approach to the whole concept of small-engined cars."

A Utah radar controller: "My Champ is more like a sports car than a compact! It puts fun back in driving—besides being convenient and economical."

A Texas parts person: "I didn't expect a less expensive car to have as much quality as this Champ does."

A self-employed Georgian: "Highway gas mileage is very close to the EPA esti-

mate. I use the power range quite frequently going onto expressways and keeping up with the traffic flow."

And a Michigan firefighter: "The Colt is one of the few economy boxes where I can sit in the back seat and comb my hair. And I'm 5-feet-11. This car has zip, zing, roadability, comfort and quality. The Japanese did it last, but they did it best!" **FM**

SUMMARY OF COLT HATCHBACK AND CHAMP OWNERS REPORTS*

	Champ	Colt		Champ	Colt		Champ	Colt		Champ	Colt
Total miles driven	580,843	715,984	Handling	9.7	5.1	Average	3.6	8.8	Dealer service opinion:		
Average miles per gallon (by engine):			Price	9.7	10.3	Fair	5.5	1.5	Excellent	23.8%	16.7%
1400-cc engine			Performance	7.1	11.0	Poor	0.9	1.5	Good	33.3	36.8
In town	29.3	30.3	Specific likes:			Comfort opinion (front seats):			Average	21.0	13.2
Long trips	36.3	37.0	Economy	74.8%	77.4%	Excellent	31.9%	32.6%	Fair	13.3	14.0
1600-cc engine			Handling	53.2	54.1	Very good	49.6	50.4	Poor	8.6	19.3
In town	30.6	30.0	Styling	29.7	23.3	Good	15.9	12.6	Number of vehicles owned:		
Long trips	36.7	36.5	Performance	24.3	8.3	Fair	1.6	3.7	One car	34.2%	41.5%
Average mpg (by transmission):			Comfort	23.4	16.5	Poor	0.9	0.7	Two cars	42.1	39.3
Four-speed transmission			Front-wheel drive	13.5	23.3	Comfort opinion (rear seats):			Three cars	14.9	11.1
In town	30.1	31.0	Specific dislikes:			Excellent	14.4%	12.9%	Four or more cars	8.8	8.0
Long trips	36.3	35.9	No complaints	21.6%	24.8%	Very good	34.6	29.8	Makes of other cars owned:		
Twin Stick gearbox			Car noisiness, rattles	13.7	5.3	Good	27.9	32.3	Plymouth	21.3%	16.5%
In town	30.0	30.3	Poor dealer service	10.8	12.8	Fair	20.2	21.8	Dodge	2.7	20.3
Long trips	36.5	36.7	Poor materials	7.8	2.3	Poor	2.9	3.2	Chevrolet	14.7	25.3
Engine choices			Difficulty in shifting	6.9	4.5	Had any mechanical troubles?			Ford	18.7	15.2
1400-cc Four	44.9%	50.4%	Not enough power	4.9	6.0	No	64.3%	53.0%	Chrysler	13.3	6.3
1600-cc Four	55.1	49.6	What changes would you like?			Yes	35.7	47.0	Volkswagen	12.0	8.9
Transmission choices			No changes	17.9%	24.6%	What type of trouble?			Pontiac	6.7	8.9
Twin Stick manual	79.8%	73.3%	Seat shape/recliner	13.7	2.5	Carburetor	32.5%	23.8%	Age distribution of owners:		
Four-speed manual	20.2	26.7	More rear legroom	5.3	1.7	Clutch	10.0	6.3	Under 20-29 years	31.8%	47.0%
Why did you choose this car?			Automatic transmission	1.1	5.9	Shift	7.5	9.5	30-49 years	49.1	34.9
Economy	72.6%	77.2%	Workmanship opinion:			Transmission	0.0	11.1	50-plus	19.1	18.2
Styling	25.7	19.1	Excellent	49.1%	41.9%	Dealer repairs satisfactory?			Would you buy another of these cars?		
Front-wheel drive	10.6	14.0	Good	40.9	46.3	Yes	66.7%	48.1%	Yes	82.8%	80.9%
						No	33.3	51.9	No	17.2	19.1

*Percentages might not equal 100% due to rounding or insufficient data.

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IT'S NEW NOW

Hot stuff

Conventional barbecues are usually heavy and require that you tote fuel around. The Sun-chef solar cooker eliminates the fuel problem, even on many cloudy days. Its elliptical reflective surface concentrates the sun's rays in a band 2x26 inches. The 9x24x26-inch cooker weighs less than three pounds and is easy to assemble, the maker says. About \$13 from The Mother Earth News, Box 70, Hendersonville, N.C. 28739.



Ultrathin watch

Billed as the world's thinnest watch, the Concord Delirium I is 1.98 mm thick. To achieve such thinness, it was necessary to develop the world's smallest battery, motor and quartz tuning fork, as well. About \$4400. North American Watch Corp., 1345 Sixth Ave., New York, N.Y. 10022.



For drinking and driving

Coffee, that is. The Travel Tankard won't spill a drop until its button is pushed, according to the manufacturer. The containers are said to be unbreakable and double-wall insulated. The top twists off for cleaning purposes. About \$6 from Thermo-Serv, 2939 Sixth Ave., Anoka, Minn. 55303.



Join the club

Beneath a removable plate on the bottom of a M.A.S.S. (Modular Adjustable Swingweight System) golf wood are 18 holes in which small weights in the form of pins are placed. Adjustment of pin placement and number helps decrease a golfer's bad swing characteristics to control slice and hook, the maker claims. The clubs cost about \$60 to \$80 each. Minnesota Golf Manufacturing Inc., 36 North Plaza Building, Gamble Center, Minneapolis, Minn. 55416.

Stain over paint?

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but they convinced me."**



Since 1940, Roy Hertel had always used paint on his house. So, when we asked if we could stain it, he was a little skeptical.

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"It turned out beautiful. We love it and so do the neighbors.

"Our house was nice before, now it's distinctive."

Thank you, Mr. Hertel.

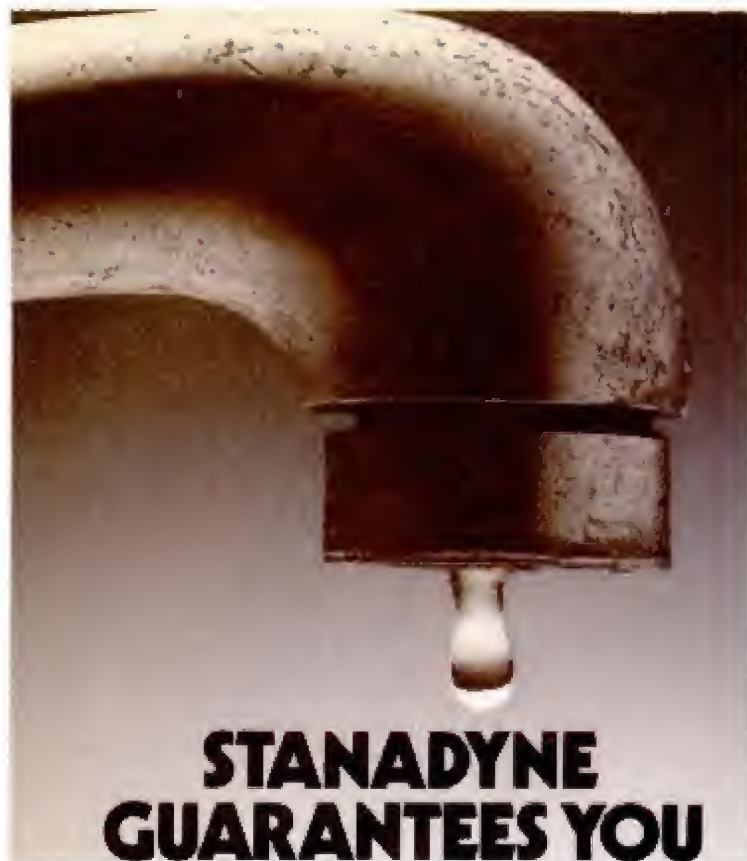
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OLYMPIC LATEX STAIN.



STANADYNE GUARANTEES YOU WON'T HAVE TO LIVE WITH A DRIP.

TUNE UP YOUR BIKE *(Continued from page 127)*

num chainwheels, and don't do it to a Schwinn because Schwinn's have never needed this fix).

The classic symptom of dull chainwheel teeth occurs when you're riding in first gear and the chain spontaneously derails to the inside. Some mechanics try to fix this by adjusting the front derailleur so it constantly rubs the chain, forcing it to stay on the chainwheel. That's wrong—the front derailleur should touch the chain only during shifts.

Fix as follows: Remove the chain from the chainwheel. Wedge a fairly fine flat file between the two chainwheels so it grates on the smaller chainwheel, sharpening the teeth (Photo 15). Rotate the crank for a minute or so, removing about 1 mm of metal from the side of the teeth. You'll grind off the chainwheel's chrome plating, but oil from the chain will continue to ward off rust.

Result: The chainwheel teeth will snag the chain, instead of allowing it to walk over them in a path to permanent derailment. If you have trouble with the large chainwheel snagging teeth, file it, too.

Truing the wheels

As your bicycle is ridden, spokes stretch and the wheels acquire potato-chip-shaped warps. Truing a wheel is much easier than most people believe; it takes only about five minutes, with a little practice.

First, mark where the warps are. Deflate the tire and hold a crayon or piece of chalk next to the rim and spin the wheel, so the rim rubs the crayon during its erratic swings. Now correct the warps by slightly tightening the spoke nipples on the side you want the

rim to lean toward, while loosening the spokes on the other side (Photo 16). Do an equal amount of loosening on one side, for all the tightening you do on the other, and do everything in increments of a half-turn of the spoke wrench. Be patient—you'll soon get the hang of it. **PM**

NEW CAMERAS *(Continued from page 75)*

zoom that comes teasingly close to being the much-awaited "universal lens." It's not, because it's still a bit slow and falls a little short in the telephoto range, but it's still quite an achievement. It's expensive (\$595) and heavy (20½ ounces), but is only 3¾ inches long. Similar lenses from Rokunar and Makinon should also be available soon.

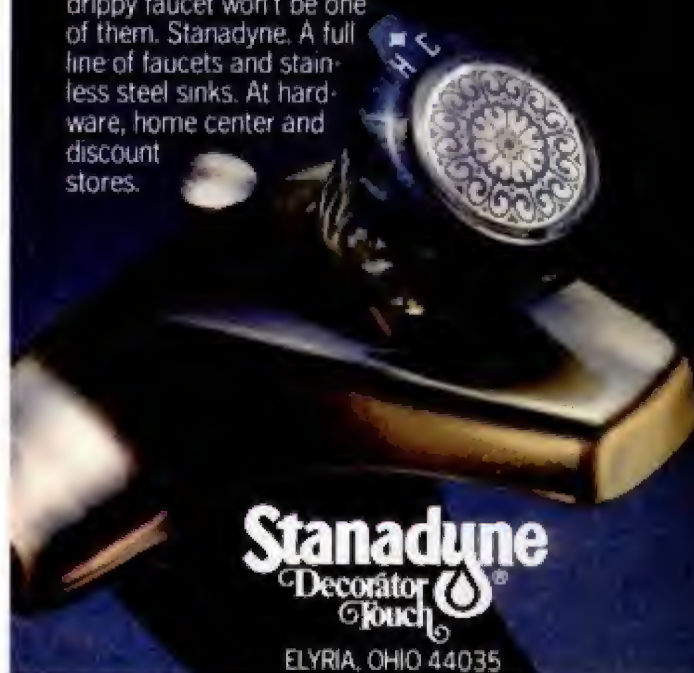
Single-focal-length lenses are also shrinking, and the new Minolta 250-mm, f/5.6 is a perfect example. This catadioptric (mirror-type) lens is only 2⅞ inches long. Its fixed-aperture design can make shooting with it somewhat inconvenient, but outdoors it should pose few problems. The price is \$380.

Light meters

Most cameras have built-in light meters, but more and more photographers seem to be buying separate hand-held meters. Vivitar has introduced two servo-controlled units with no moving meter needles and two with digital readouts. The top-of-the-line 260LX and 230LX can be used both as light meters and as flash meters. They're \$225 and \$208, respectively. Quantum Industries, makers of the digital Calcu-Light meter, just introduced a digital flash meter, Calcu-Flash (\$185).—Tom Sahagian

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 1/2" x 1 1/4" (2)

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 1 1/2" x 1/2" dia. (2)

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Fine Thread
 1/2" (2), 3/8" (2), 1/4" (2)

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Wire Hose Clamps

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Extension Springs

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Grease Fittings

1" 90° (2), 1" Straight (2)

Internal Retaining Rings

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JULY 1979 133



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Four-stroke moped

The need for pre-mixing gas and oil is eliminated on the Indian four-stroke moped, as is a need for engine decarbonizing. The 49-cc powerplant can be adjusted to put out from 1.2 to 1.9 hp; three different rear-wheel sprockets are included to assure compliance with various speed laws. About \$560. American Moped Associates, 1852 Langley Ave., Irvine, Calif. 92714.

Small pack for small fry

The Little Hiker is a 1-pound, 14-ounce backpack designed for 4- to 9-year-olds. The frame has an adjustable crossbar to accommodate body growth. The nylon pack bag has a vertical zipper for easy access to gear in the bottom. About \$25 from Antelope Camping Equipment Mfg. Co., 21740 Granada Ave., Cupertino, Calif. 95014.



Water on the bulb

When launching a boat, a trailer's stoplights can shatter if water leaks in and touches the hot bulbs. The usual solution to the problem is to disconnect the lights before launch, but a plastic-coated bulb makes that unnecessary. The coating insulates the bulb from the water, the maker says. A pair is \$2.20 from Dyna-Plastics Inc., 3205 Forge Rd., Shreveport, La. 71109.

Tools in the round

These six-ended Multi-Tools fit a variety of fasteners. One fits three sizes each of Phillips and conventional slotted screws; one fits metric Allen setscrews from 2 to 6 mm; one has six sockets fitting bolts from $\frac{3}{16}$ to $\frac{7}{16}$ in. Two others (not shown) fit standard Allen setscrews or Allen capscrews from No. 8 to $\frac{7}{16}$ in. Price is approximately \$5 to \$6.50. Grover Patent Products, 339 West Arden Ave., Glendale, Calif. 91203.



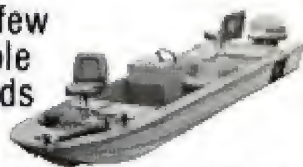
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made automobiles. An average of 76 percent scored their cars *good to excellent* in workmanship. Admits a Wyoming service manager for a Ford dealer: "Workmanship and quality are excellent. All parts fit well, and the design is superior." A Michigan manufacturer's rep: "Everything on my TC3 fits tight. No rattles. Paint super." And a Georgia music director: "The Omni 024 has the best workmanship, in my opinion, of any small, American-made car, and I drove them all."

The TC3 and 024 generated plenty of comment on styling. The cars' shape certainly helped considerably in making initial sales, and almost every owner admitted he'd been smitten. "I loved it the first time I saw it on a magazine cover," coos a Texas receptionist. "The body style is pretty. In fact, the whole car is terrific except for the gas pedal."

An Ohio tool-and-die supervisor: "This TC3 is supposed to be an economy car, but it gives me such pleasure to own and drive that I feel as though it's a special sports car. Maybe it's the European styling, the rally instrument panel, the feel of the bucket seats. Whatever it is, I enjoy the car thoroughly, and in the meantime it's saving me \$11 a week in gas."



024 and TC3 use 70-hp, Volkswagen-based Four mounted transversely.

A West Virginia housewife writes, "The 024 is the most sporty-looking and roomy car I have seen anywhere." A New York plumber: "I wanted an Omni from the beginning and fell in love with the 024's looks."

As for comfort, a New York real-estate appraiser spoke for many, noting, "Front comfort and roominess are excellent. The rear seat, because of the steep slope of the hatchback, is poor. But it's a fun car to drive!"

A Michigan repairman claims, "If you're over 6-1, there's no headroom in the front, and anyone over 5-6 won't like it in back either." A Michigan salesperson:

"We recently drove 300 miles with three adults and two young teen-agers in the car. All were quite comfortable."

Several owners suggested seat recliners be added up front, and a Minnesota service technician recommended, "The driver's seatback could be tilted back slightly for better leg comfort. I'm 5-10 and imagine that taller drivers would appreciate this even more."

We always ask owners to suggest ways to improve their cars. Here's a sampling of I'd-like-to-sees:

"Larger gas tank—this one holds only 13 gallons."—Ohio newspaper reporter.

"Needs a temperature gauge. I have the rally cluster and am disappointed that this gauge is missing. I'd also appreciate a cover for the rear compartment so everything's not exposed to public scrutiny."—Illinois bookkeeper. (A rear tonneau is optional.—Ed.)

"It would be nice to have a five-speed transmission, adjustable steering column, and reclining seats standard."—Michigan business manager.

"The standard disc brakes without power assist seem to be sluggish and require more than normal pedal pressure. I think power ought to be made standard,



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As temperatures change, wax warms on your car. As wax softens, it acts like a magnet to attract, and collect dirt in the paint. By applying more wax, you actually "grind" dirt into paint pores. Whether you wax or not, when dirt gets into the pores of paint, it causes the glossy finish of your car to fade, and promotes paint rot. Merely pour liquid CHEM-GLAZE on a rag, wipe it on your car, then wipe it off. The liquid easily flows into the pores of the paint, brings dirt to the surface, and, within one hour, hardens, or "cures" into paint pores.

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not optional."—West Virginia flight engineer.

To sum up with a few overall, all-around comments:

"I frankly couldn't be happier with my TC3. I attribute my ability to weather the Chicago blizzard of Jan. 20, 1979, to the car's fwd and superior handling. The car's

styling is the best thing to come along in a long time."—Minnesota engineer.

"I've driven my 024 on the expressway and deliberately changed lanes quickly at high speeds. The car handled it smoothly, with no inclination to be jerky or go out of control."—Illinois clerk.

And a Wisconsin hair stylist: "Overall, I

really like my Omni. It looks and feels fantastic. It handles smoothly and has just enough power for me and my requirements. The Dodge dealer is one of the best I've ever dealt with. He's considerate and has treated me as well when I come in for service as he did when I bought the car." **FM**

SUMMARY OF HORIZON TC3 AND OMNI 024 OWNERS REPORTS*

	Horizon TC3	Omni 024		Horizon TC3	Omni 024		Horizon TC3	Omni 024		Horizon TC3	Omni 024
Total miles driven	395,332	334,474	Specific dislikes:			Poor	0.0	0.8	Average	21.9	19.8
Average miles per gallon:			No complaints	28.0%	22.0%	Comfort opinion (rear seats):			Fair	6.1	9.0
Four-speed manual			Seat shape and style	8.3	6.8	Excellent	5.5%	3.4%	Poor	14.0	12.8
In town	25.8	25.5	Poor dealer service	6.8	2.5	Very good	10.9	8.5	Number of vehicles owned:		
Long trips	32.0	32.1	Poor workmanship	6.8	5.9	Good	25.8	19.5	One car	36.0%	40.0%
Three-speed automatic			Squeaky brakes	5.3	5.9	Fair	32.0	34.7	Two cars	42.4	39.2
In town	23.5	23.5	Not enough power	5.3	5.9	Poor	25.8	33.9	Three cars	16.5	11.2
Long trips	29.7	28.2	What changes would you like?			Had any mechanical troubles?			Four or more cars	7.0	9.6
Transmission choices:			No changes	18.3%	19.3%	Yes	50.4%	56.3	Makes of other cars owned:		
Three-speed automatic	40.1%	30.4%	More legroom	11.1	7.6	No	49.6	43.7	Plymouth	37.1%	8.1%
Four-speed manual	59.9	69.6	Better seats	7.9	17.6	What type of trouble?			Dodge	6.7	32.4
Why did you choose this car?			Five-speed gearbox	4.0	10.9	Carburetor	17.1%	27.1%	Ford	19.1	14.9
Economy	67.9%	65.9%	Full working instruments	4.0	3.7	Transmission	17.1	11.4	Chevrolet	10.1	21.6
Styling	48.2	58.7	Workmanship opinion:			Alternator	12.9	8.6	Pontiac	11.2	8.1
Front-wheel drive	29.9	34.1	Excellent	26.6%	26.8%	Electrical	8.6	8.6	Chrysler	7.9	6.8
Handling	10.2	13.5	Good	48.9	49.6	Clutch	7.1	2.9	Jeep	4.5	8.1
Price	9.5	11.1	Average	14.4	18.1	Dealer repairs satisfactory?			Age distribution of owners:		
Specific likes:			Fair	5.8	4.7	Yes	60.7%	64.6%	Under 20-29 years	40.5%	53.6%
Economy	65.4%	56.5%	Poor	4.3	0.8	No	39.3	35.4	30-49 years	49.3	32.0
Handling	59.6	62.9	Comfort opinion (front seats):			Dealer service opinion:			50-plus	10.1	14.4
Styling	52.2	62.9	Excellent	43.1%	36.2%	Excellent	22.8%	20.7%	Would you buy another of these cars?		
Front-wheel drive	23.5	22.6	Very good	32.1	39.4	Good	35.1	37.8	Yes	90.0%	88.0%
Comfort	14.7	13.7	Good	22.6	18.9				No	10.0	12.0
Power	10.3	13.7	Fair	2.2	4.7						

*Percentages might not equal 100% due to rounding or insufficient data.

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You can save a lot of fuel, money and exertion—and still have fun—when camping in a motor home or trailer. Here's how.



Tips on energy-efficient living in an RV

by Ruth Deal

While building our new home, we have been living on our lot in our travel trailer—and have found a lot of ways to save both energy and money. Thousands of people who live in recreational vehicles and mobile homes might find some of our tips helpful to them, too, and many would work in a regular house, as well.

In central Texas, we are exposed to over-100° summers and 13° winters, with winds to 35 mph that can create a severe wind-chill factor. We use electricity and bottled gas for heat, and quickly learned how fast it could disappear when canceled out by wind seepage and lack of insulation.

Our 18-foot trailer is 12 years old and on trips we found that winds could whistle through joints and cracks, particularly in the cabinets, the storage area under the gaucho bed where the water tank is located and in the wardrobe. So first my husband, Bob, caulking gun in hand, crawled under, into and on top of every place he could see light from the inside and sealed off all leaks he could find. Then we packed fiberglass insulation into every place possible. The improvement was impressive.

Carpeting, drapes help

The floor still tended to be cold, however, even though it had a layer of indoor/outdoor carpet. We found a piece of very thick shag rug, put it down as added insulation, and discovered another big difference. Our draperies, already a very heavy material, are kept closed in cold weather and help retain heat.

We also found the way we aim our trailer is important—something you can't do with a house, unless you

plan in advance. Our wardrobe and bathroom are at the rear. By facing them to the north, where our colder winds come from, they help insulate the rest of the trailer from the worst storms.

Double-duty range

Our built-in butane space heater, we learned, was in a poor location and used too much fuel. And our small electric heater drew a great deal of current. Instead, we found that one or two burners on our butane stove will keep our small RV snugly warm.

While I am heating some water in a heavy pan for dishes, bathing and hand laundry, or cook beans or pot roast, the range is doing double duty. We also place firebricks on the burners. Once heated through, they give off warmth for several hours with the burners turned off. They must be *firebrick*, however; ordinary bricks can explode or crumble. If using the burners for heat, be *very sure* there is ventilation so fumes can escape and fresh air can come in. Our propane lamp also gives off considerable heat, as well as providing good light.

Rather than keep burners going all night, which heats the trailer unnecessarily and is of questionable safety, we use our electric blanket, which has a relatively modest current drain.

In summer, we turn the trailer so that prevailing breezes blow through the windows to help keep it cool. A fan to circulate air also uses much less current than an air conditioner. At night we open windows to let in cool air, then close them in the morning to conserve it. Closing the drapes on the sunny side helps as well, and putting an awning above

the trailer is worthwhile if you have no shade trees.

During warm months we use the stove as little as possible. Cool meals are welcome, and when I do cook I use both top and bottom of a double boiler over one burner. The bottom can be boiling potatoes or vegetables, while the top is heating leftover meat or spaghetti. Divided pans that can cook two foods at once are also energy savers. Compare cooking costs of bottled gas, a hot-plate or electric cookware; then choose the most economical. By cooking larger amounts, you can plan cold leftovers for another day. Some foods can be doubled up for heating, too.

Use dying coals

Summer evenings we often cook over an open fire outdoors, then put a kettle of water on the fire to heat overnight. Take all precautions, of course, before going to bed. Circle the fire with large rocks, clear away all twigs and dry grass, and make sure you have built the fire in a safe place. Only dying coals are needed, not a flaming fire. Boiling water put in a Thermos with dry oatmeal the night before will still be hot for breakfast. And coffee put in the Thermos after breakfast is still hot and requires no heating at coffee-break time.

We only need to use the trailer's water heater for showers. In the summer, a dark container placed in the sun can warm water to dish-washing temperature. But, be sure the sun is not heating your refrigerator. Close shades to keep the sunlight off it. If you're lucky enough to have a nonpolluted stream or spring nearby, let it cool drinks, eggs (in a sturdy container), fruit and other foods, saving both refrigerator space and the extra electricity used because of constant opening.

Outdoor activities in the evening further reduce electricity consumption; bicycles can save gasoline. What worked so well for our grandparents may save dollars and energy for us, as well.

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HINTS FROM READERS

Easily made shop compass



This compass for drawing over-size circles is made of a cork, some string and a pencil. Thread the string through the cork with a heavy-duty needle. Use a nail as a center pivot and slide the string through the cork to adjust the radius. Mark with the pencil held in the looped string.—Howard E. Moody

Table saw cuts multiple circles



This jig allows you to cut multiple duplicate circles. Cut a base of $\frac{1}{2}$ -in. plywood like the 10x16-in. one shown. Cut a strip of hardwood to suit your miter gauge slot and the length of the base. Locate it on the base so it will fit in the slot when the base is positioned as shown. Attach it with two countersunk $\frac{3}{4}$ -in. No. 4 flathead screws.

Next, you measure the precise distance from blade to radius of the circles you will cut, and bore a hole in base at that distance to accept a 2-in. length of $\frac{1}{4}$ -in.-dia. dowel; secure it with white glue. To make a circle, bore a centered hole in workpiece so it slips over dowel. Make repeated cuts, turning the piece after completing each cut.—R.H. Griffiths

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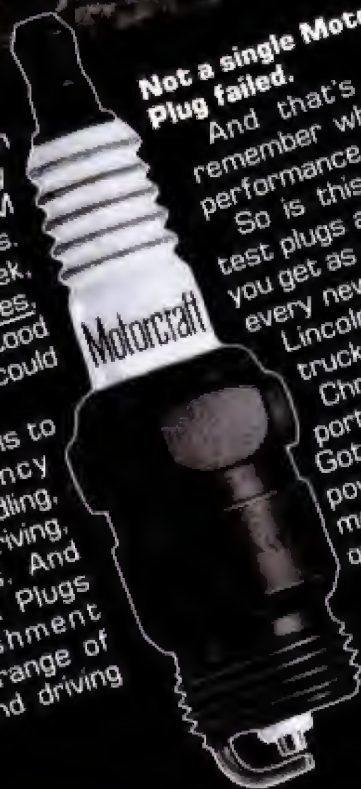
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DON'T ASK FOR TROUBLE. ASK FOR MOTORCRAFT.

AUTOMATIC TRANSMISSION QUIZ

(Continued from page 59)

most trips of less than 10 miles).

Servicing is done as follows:

■ Warm up the transmission by driving the car at least 10 miles and drain fluid. Some transmissions have drain plugs. With others you loosen transmission pan bolts and pry the pan loose to drain the fluid. Then remove the bolts and drop the pan.

■ Drain the torque converter, if possible. Some converters have drain plugs. Others don't; fluid from the converter cannot be drained.

■ Examine the oil pan (see answer to question No. 10). Then clean the pan in solvent, making sure old gasket material is removed from pan and transmission housing flanges.

■ Unscrew the filter and install a new one.

■ Using a new gasket, reinstall the oil pan, torquing bolts to service manual specs.

■ Refill transmission with approved fluid (see answer No. 7).

3. (d). Check transmission fluid level. Low fluid level causes air in the fluid, which, in turn, leads to abnormal operation because of spongy hydraulic action, delayed clutch engagement, and slipping of clutches and bands. If fluid is allowed to remain low, overheating results and accelerates clutch and band wear.

Check the transmission fluid level immediately after a drive of at least 10 miles. Park on a level surface. Set the parking brake. Let engine idle.

Move the selector lever slowly through all shift positions and return it to PARK or NEUTRAL (consult owner's or service manual). Generally, GM and Ford transmissions are checked in PARK—AMC and Chrysler in NEUTRAL. Clean the dipstick tube and cap. Pull the dipstick, wipe with a clean cloth and reinsert. Pull again and check fluid level.

4. (d). The transmission is performing normally. Fresh fluid is clear red. The fluid darkens with age, normal as long as fluid remains clear.

5. (a). A leaking transmission oil cooler is allowing engine coolant to mix with transmission fluid. The fluid has become emulsified and looks milky. The transmission and torque converter will have to be replaced or overhauled, if the transmission doesn't respond to having fluid and filter changed, radiator leak repaired and oil cooler lines flushed.

6. (b). Overheating has taken place, causing disintegration of clutch and

(Please turn to page 144)

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AUTOMATIC TRANSMISSION QUIZ

(Continued from page 143)

band friction material. Burned fluid may appear black, instead of dark brown. In any event, overheating gives fluid a definite burned odor. Overheating occurs because of a clogged transmission oil cooler, clogged oil cooler lines, excessive band and clutch slippage brought about by a constant low fluid level, or towing too-heavy loads. Overhauling or replacing the transmission and torque converter, including the transmission oil cooler, will probably be necessary.

7. (a), (b) or (c). "Any of the above" (d) is no answer to this trick question. The fluid you put into your transmission should be *the one* recommended by the manufacturer. Consult the owner's or service manual, since Dexron and Dexron II are not compatible with transmissions requiring Type F. Using the wrong fluid can cause transmission failure.

8. (a). Do nothing. Everything is okay. If fluid is on or below the ADD mark, add enough to bring it between ADD and FULL or to the FULL mark. If fluid is above the FULL mark, draw out excess through the fill tube, using a syringe outfitted with a hose. A high fluid level causes gears to churn up foam, forcing fluid out the transmission vent, resulting in a bell-housing drip that can be mistaken for a front-seal leak.

9. (a), Improper filling of the transmission and (b), a leak. Transmission fluid does not evaporate and is not "used up." If an underfilled transmission is filled and shortly thereafter again shows a low fluid level, look for leaks. The most likely places are at the base of the filler tube, speedometer gear, cooler fittings, bell-housing, oil pan and transmission rear seal. Frequently, a leak requires a trans overhaul to replace faulty seals.

10. (c). Particles from clutches and bands are clinging to the pan. The interior of the pan should be clean and shiny. Some pans have a magnet to attract particles, making detection easier. Clean off the magnet.

Scoreboard

If you got 8 to 10 right, you're an expert.

If you got 5 to 7 right, review answers you got wrong.

If you got only 0 to 4 right, you need more than boning up. Burn the midnight oil until you know answers by heart!

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MORE TURKEYS!

In response to our story *How to Spot a Turkey!* (Dec. '78), readers have deluged us with letters, many of which add to ways you can spot bad drivers.



Wade Hoyt's article, *How to Spot a Turkey*, was fantastic! Not only was it amusing, it was also written in such a way that maybe the "birds" he describes will recognize themselves and shape up. However, he missed one.

The bird I am referring to only comes out in the winter. He thinks that leaving the snow all over his windows will insulate him from the cold and possibly pad him in case of a crash. Like the ostrich, he thinks that if he can't see the other cars, it means that they are not there. Maybe this will alert drivers to the "Snow-Covered Dodo."—*Valeria Giordano, Woburn, Mass.*

I have found that the nut who charges through traffic, changing lanes and creating a threat to those in front, behind or in even the remotest vicinity, invariably sports a CB antenna.—*James Stevenson, Duncannon, Pa.*

Wade Hoyt made one glaring omission: the red car—I mean fire-engine red. This color seems to reflect its owner's temper, hostility and aggressiveness perfectly.—*W. James Waterman, San Antonio, Tex.*

Another nomination for the "Turkey" Hall of Fame: The driver who refuses to turn on headlights, unless he happens to be driving on an overcast, moonless night at midnight! He will not use his headlights at dusk or dawn or during fog, heavy rain or snow. He fails to remember it is as important to accident prevention that he be visible to other drivers, as it is for him to see other vehicles.—*John Walters, Newark, N.Y.*

Be wary of the "Antique Aardvark." This slow-moving senior citizen is often seen in the extreme right lane or on the shoulder of the

road. Although their plumage is ruffled and their bumpers may be rusty, these nearly extinct creatures deserve your attention and courtesy.—*Bob Larkin, Alexandria, Va.*

Here are some personal favorites:

"Rumpled Grouse," Sub-category, **"Busted Butt":** Rear of the car shows considerable signs of conflicts with other vehicles and objects. Prone to do the unexpected. Will suddenly stop, for no visible reason, on highway, from 55 mph. Makes left turns from right lane and right turns from left. Has never found turn-signal lever.

Imperious, One-Eyed Lane Blocker: Only left eye works. Always drives in left lane, or hugs center line on two-lane roads. Lack of vision in right eye makes it impossible to judge how far away right side of car is: hence, keeps left.

Sub-variety: One-Eyed Righteous Rule Reader: This left-laner is especially fond of rule-reading. Knows those other cars shouldn't be passing on right. Is at or below speed limit, usually the latter because it has heard of rule about "safe speed for existing conditions" and has personally determined what this speed *will* be.

Long-Feathered Horn-Blower: Distinguished battle scars on front of vehicle help to identify this creature. It is convinced that horn button is the solution to collisions. Has never figured out exact location of brake pedal, so pushes horn button instead. Frequently seen, and heard, plowing into the back of multiple-car accidents.

Sheep-Bird: Always found in groups, except when seeking one. Only feels safe when surrounded by

other cars. Will travel 20 mph above or below speed limit to find a group to join. Rules are strict, requiring Sheep-Birds to drive abreast of other cars, utilizing all available lanes. Especially abundant during foul weather.

Sub-variety: "Chicken Sheep-Bird": Especially hazardous to non-Sheep-Birds. Has difficulty recognizing its own breed. Will "join-on" any car it finds, either by high-speed approach from the rear, or low-speed waiting in front. As soon as you are alongside, will match speed to yours.

Dim-Wit Bird: Car was delivered with headlights in "bright" position, and Dim-Wit has never changed their position. Probably has failing vision anyway, as it even runs on brights in daytime.

Uncertain Blind Bird: Believed to be a crossbreed between the "One-Eyed" and "Sheep-Bird" species. Always in center lane on three-lane roads, due to lack of distance judgment. Vision believed to be blurry, so is frightened by movement on either side; hence will attempt to join any cars passing it. Will make right and left turns from center lane.

Bus Bird: Has never driven one, but drives like he has. Frequently found in subcompact cars. Needs a minimum of two lanes to negotiate a turn from one road to another, even in a Datsun. Will first swing out away from direction of turn to gain room, then make the turn.

Vulture Bird: Slows considerably and suddenly, at the first sight of any car(s) on either shoulder. First on the scene of minor bumper benders, slams on brakes, or shifts to lower gear (for more surprise), causing multiple-car disasters.—*G. Graham, Jackson Heights, N.Y.*

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Recycling old cans is not new, but New Mexico architect Mike Reynolds has come up with a unique way to do it—he builds houses out of them. Reynolds hit on the idea when he learned that container makers produce 30 billion 12-ounce beverage cans a year, many of which end up as unsightly litter on our shores and countryside. Why not put this trash to work and at the same time help clean up our environment? Mike did some fast calculating and was astonished to discover that, "Those 30 billion cans are enough to make 300,000 houses—a year!"

The house shown here, Reynolds' first experiment in "canstruction," was built for a Taos, N.M., lawyer, Steve Natelson. Mike chose a circular design, both to test the flexibility of the new building material and to simplify construction for unskilled labor—curved lines are easier to produce than straight ones. The

cans are wired together in bundles of eight each, then laid up with mortar just like ordinary cement block. The exterior is plastered over to create a rustic finish similar to stucco or adobe.

A novel touch: Green grass growing on the roof is Natelson's "lawn"—a mini oasis in the arid, dusty New Mexico desert. The grass roof, consisting of six inches of soil topped with sod, provides good insulation against the broiling desert heat and doubles as a pleasant patio—where no patio should normally be. The one-bedroom, 11,000-square-foot house required 75,000 cans, scrounged from junk heaps for virtually nothing. Construction cost ran to \$17 a square foot, but Reynolds thinks this will come down to \$12—well below current building prices—because of cost-saving shortcuts learned from his first venture. It's a "canny" idea.

"House of cans" looks odd under construction (top), but takes on attractive adobe appearance when finished. At left, owner Natelson waters rooftop "lawn."



Interior view shows curving walls of circular house and comfortably rustic living room. Natelson lounges in unusual hammock slung from ceiling beams.



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		1	2	3	4	5	6	7	8	9					
1	MICRO-CHESS 1.0 (Heath H-8)	W	X	%	0	1	0	0	0		1	3	0	2%	7*
2	MICRO-CHESS 1.5 (TRS-80)	W	%	X	%	%	0	0	0		0	5	7	2%	6*
3	MICRO-CHESS 2.0 (PET)	W	%	1	X	1	0	0	%		3	4	5	5	4
4	CHESS CHALLENGER (3 Level)	W	1	1	%	X	0	%	%		2	5	5	4%	5
5	CHESS CHALLENGER (10 Level)	W	1	1	1	1	X	1	%		10	2	0	11	1
6	BORIS	W	1	%	1	1	0	X	1		7	2	3	9	3
7	SARGON I (TRS-80)	W	1	1	1	%	%	1	X		6	5	1	8%	2
8	ATARI Did not play	W								X					

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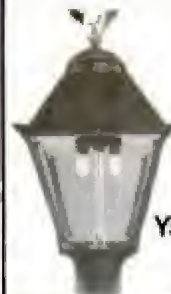
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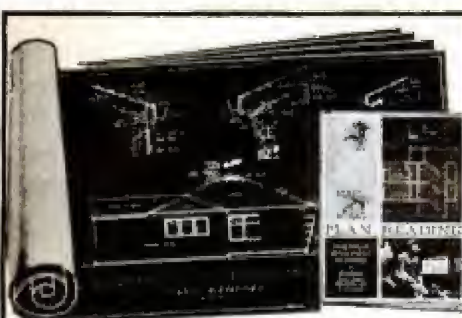
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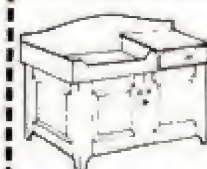
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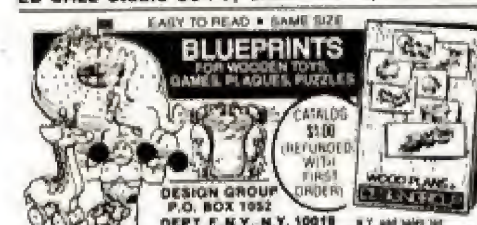


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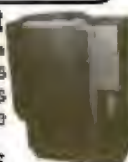
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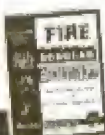
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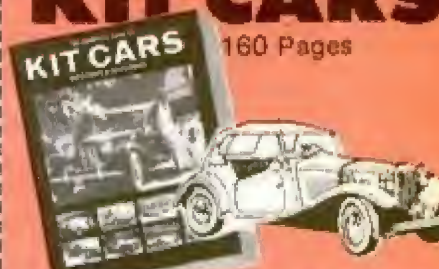
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you can use your Koolatron as a bar fridge all winter and a patio fridge in the summer. Run it in your motel room at night and enjoy a midnight snack whenever you feel like it. We have customers using our portables on construction sites, in workboats, laboratories and even in locker rooms for a "cold one" after the game.

THE ULTIMATE PORTABLE REFRIGERATOR

It weighs less than most coolers with a block of ice but holds over 40 pop cans or 40 lbs. of food in its large 36 qt. capacity. Plug it in a lighter socket in your car, boat or van or operate it from a 12 volt battery charger plugged into 110 volts. Cold contents will stay cold overnight with unit off. Draws a maximum of 4 amps., averages about 2 amps. at 70 deg. F. with the thermostat on. Keeps your food cold and dry. Exterior dimensions are 21" L x 16" W x 16" H. Interior dimensions are 16" L x 11-1/2" W x 12" H.

BUILT-IN QUALITY AND DURABILITY

The rugged "ABS" case is filled with the best insulation available - rigid urethane foam. It has a "150 lb. test" handle and non-rusting polypropylene hinge and latches, with stainless steel fasteners. The exterior is harvest gold with a white interior and has 4 non-slip rubber feet. Your portable comes with a 9 ft. detachable cord which plugs into your cigarette lighter. It also has terminals for attaching wires directly from a battery or fuse panel. The same terminals are used for your battery charger clips when operating from a charger. A reverse polarity warning light & buzzer are included. The Koolatron was designed so that the fan motor can be replaced by you with only a screwdriver. No other service should ever be required except for physical damage which can be repaired at our depots in Batavia, N.Y., or Barrie, Ontario.

GUARANTEE. 21-DAY MONEY-BACK TRIAL PERIOD

Your Koolatron comes with a written 1 year guarantee plus complete instructions and helpful information about batteries and chargers. If for any reason you are not totally satisfied, return it for a prompt refund in full.



BUY NOW AT OUR NEW LOW PRICE

Good news. Our increased sales have overcome mounting material costs. So for now we can pass on a



The Koolatron portable keeps 40 lbs. of food at house-hold refrigeration temperature but weighs only 15 lbs. Only 21" x 16" x 16" ext. Model F1A shown.

saving of \$10.00 per unit. Formerly \$169.00. Now \$159.00 + \$7.00 handling and shipping (\$179.00 in Canada).

ADJUSTABLE THERMOSTAT OPTION

For an additional \$10.00 you can order the Koolatron portable with an adjustable thermostat in place of the standard fixed temperature thermostat - order Model F1A.

PAYS FOR ITSELF

If you are regularly using ice, your Koolatron portable will pay for itself with the money you save on ice, spoiled food, restaurant bills and the gasoline used looking for ice.

Don't Waste Another Dollar on Ice!

Phone your order in collect to

705-737-0842

Koolatron Industries Limited,
56 Harvester Ave., Batavia, New York 14020
230 Bayview Drive, Barrie, Ontario, Canada
Or use this handy order coupon.

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Dept. 523

56 Harvester Ave., Batavia, New York 14020
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Ontario L4N 4Y8

Send me ___ Koolatron F1 @ \$159.00 (\$179.00 in Canada) + \$7.00 each for handling and delivery in USA or Canada. (N.Y., Ont. and Que. residents add sales tax.)

___ I want model F1A and have added \$10.00. I understand that I may return it undamaged within 21 days and get a full refund if I am not satisfied. I enclose my ☐ check ☐ money order for \$___ or, please charge my ☐ Visa ☐ Mastercharge ☐ American Express.

Acct. No. _____

Expiry Date _____ ☐ Send brochure only

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Name _____

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City _____

State _____ Zip _____

**SOME PEOPLE LAUGHED
WHEN WE COMPARED THE LOOKS
OF A FORD GRANADA
WITH A \$22,000 MERCEDES.**

**MANY DIDN'T.
THEY OWN BOTH.**



Mr. & Mrs.
George Nazarian



"WE DON'T CONFUSE THEM,
BUT THE NEIGHBORS SURE DO."
Mr. & Mrs. Harold Wagner



"OUR KIDS CALL THE GRANADA
"MAMA'S MERCEDES."
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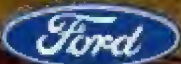
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*Compare this estimate to the estimated MPG of other cars. Your mileage may differ depending on speed, weather, and distance. The actual highway mileage will probably be less than the estimated highway fuel economy.

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